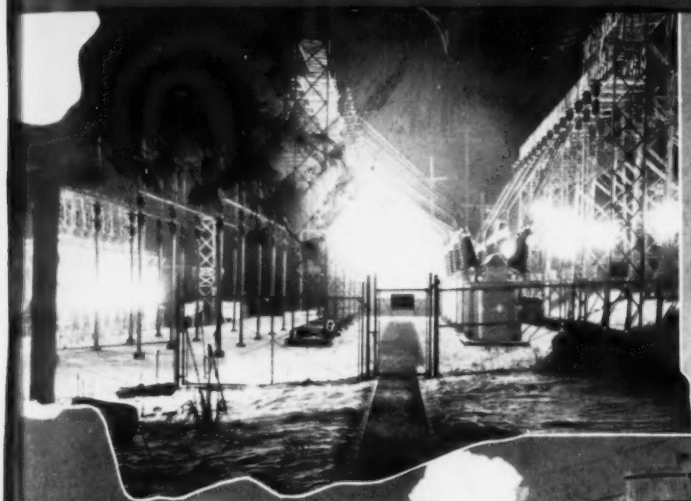
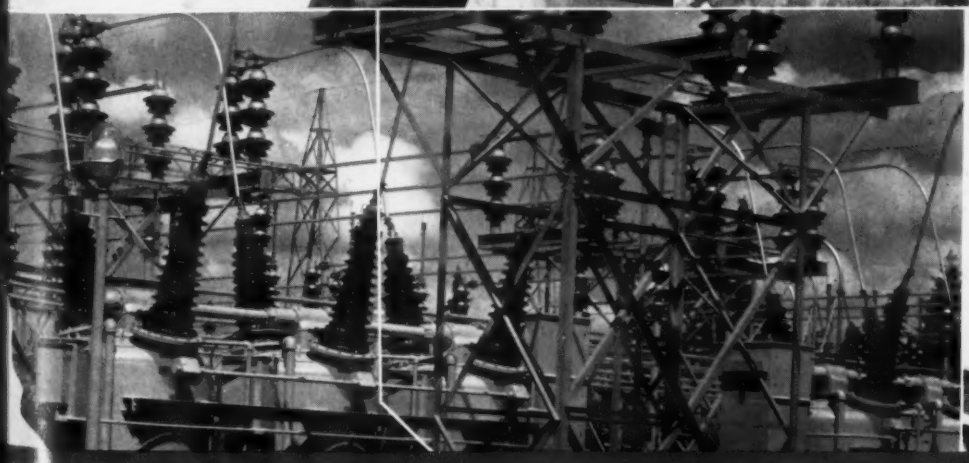
ELECTRICAL WEST

THE ALL-INDUSTRY MAGAZINE OF PROGRESS





NORTHWEST POWER POOL

MARCH 1944
25c a Copy

"KEEP 'EM FLYING ...WITH SAFETY!"
TO ALL KITE FLYERS:
Now that kite-flying weather is here, take a tip
"PLAYING SAFE DOESN'T SPOIL THE FUN!"
Stay away from power lines!
"HAVE A GOOD TIME, BOYS...BUT KEEP YOUR KITES AWAY FROM THE POWER LINES!"
Keep'em flying...with safety!
Good kite flyers heed the four safety rules
"DON'T TRY TO PULL IT DOWN!"
KEEP 'EM FLYING...WITH SAFETY
1. Fly kites in an open field, away from power lines and other overhead

"MY FRIENDLY WARNING TO KITE FLIERS"

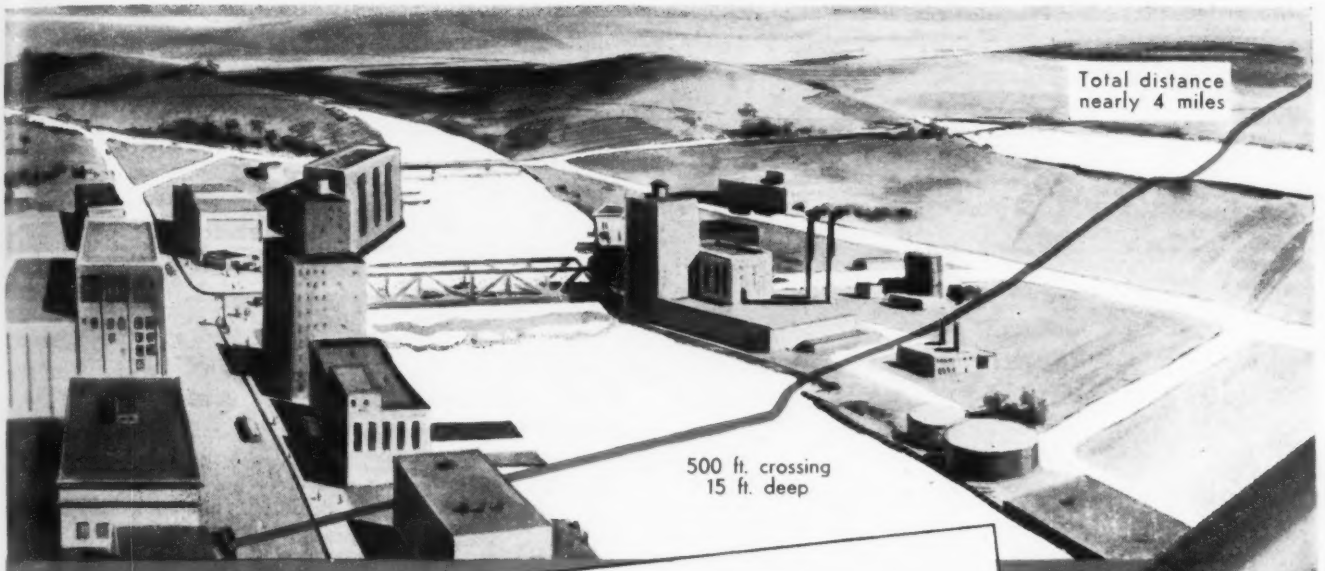
"Youngsters who fly their kites near electric power lines endanger their lives and may cause interruption of service to vital war industries. To help prevent such accidents, I've been telling the public about the danger of flying kites near power lines, and suggesting safety rules. Shown here are the advertisements I appeared in. They were published in nearly 200 newspapers throughout Edison territory."

Reddy Kilowatt

CONSERVATION OF ELECTRICITY WILL HELP WIN THE WAR

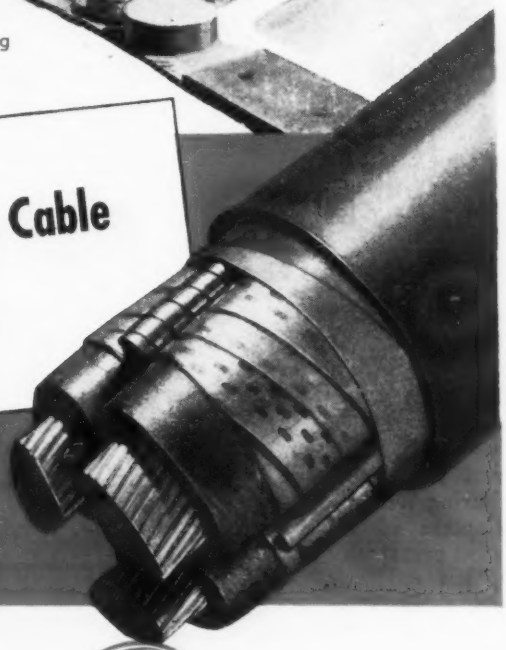
SOUTHERN CALIFORNIA EDISON COMPANY LTD.

ELECTRICAL WEST (with which is consolidated The Journal of Electricity), March, 1944. Vol. 92, No. 3. Published monthly by the McGraw-Hill Company of California, 68 Post Street, San Francisco, 4, Calif. Entered as second class matter at the post office at San Francisco under the Act of March 3, 1879. Additional entry as second class matter at the post office at Los Angeles. Printed in U. S. A. Subscription rate in U. S. and U. S. possessions, and Canada, $2 per year; all other countries $3 gold. Single copy 25c. Copyright, 1944 McGraw-Hill Company of California



The First SUBMARINE INSTALLATION

Low-pressure Gas-filled Cable Goes on 34.5-kv Duty



ONE Midwest utility, already serving a capacity load on its 34.5-kv network, had to increase that capacity in order to supply a new war plant. The best method was to put in a two-circuit, direct tie between two points in the system nearly four miles apart.

The only route available for this tie lay through a congested duct system in a downtown area, and included two 500-foot river crossings, with a water depth of 15 feet.

Various types of cable were considered. Some were unsuited because of small manholes, congested conditions in the downtown area, or the possibility of electrolysis. The requirements indicated a need for the simplest type of cable affording the utmost reliability at low cost.

Therefore, gas-filled cable, with its favorable thermal and dielectric characteristics, was selected. Also, sheath damage to this type of cable can be detected without circuit failure. The installation is now in successful operation.

For information about G-E gas-filled cable, ask the nearest G-E office for Bulletin GEA-3652, or write *General Electric Company, Schenectady, New York.*

GAS-FILLED CABLE *Offers*

1. SELF SUPERVISION—prompt automatic warning if a leak occurs
2. ECONOMY—easy to install, no auxiliary manhole equipment
3. SMALL SPACE REQUIREMENTS—more power for a given duct size
4. UNIFORMITY OF INSULATION—no need to worry about compound migration

Invest in your future. BUY WAR BONDS

GENERAL ELECTRIC

601-19-1200

Here in the WEST

People

H. B. Walker

whose article is on p. 74, has been professor of agricultural engineering at University of California and engineer at Davis experiment station since 1928. Previously, he held a similar post at Kansas State College, which he first joined in 1910, following a year as topographer with the Chicago Burlington & Quincy railroad and another year as assistant drainage engineer of Humboldt County, Iowa. His career also has included service as engineer for the Kansas Water Commission; four years as Kansas state irrigation engineer; and a year as director of research in farm mechanical equipment for the U. S. Department of Agriculture. He was born in Macomb, Ill., and had his training at Iowa State and Kansas State colleges. During World War I, he was Captain of Engineers and went overseas as assistant division engineer, 78th division. He was in the St. Mihiel and Meuse Argonne offensives. He is a member of professional and honorary societies; was a delegate to the World Engineering Congress at Tokio in 1929. He has been chairman of the California Committee on the Relation of Electricity to Agriculture since 1930; served a term as president of the American Society of Agricultural Engineers.

Howard Dodge

senior engineer for Underwriters' Laboratories Inc., San Francisco, furnished the information respecting that organization which is found on p. 66 of this issue. He started with Underwriters' almost the day after he was graduated from California Institute of Technology; for nearly four years has been in charge of the San Francisco laboratory. Previously he was inspector in Los Angeles, working under H. F. Ufer, Western superintendent of the Laboratories.

Pages

Kilowatt-Hours Pooled for War 51
By Walter C. Heston—Highlights and accomplishments of the Pacific Northwest super power pool are told in the first complete article to be published on this outstanding interconnection of utility systems.

"Approved by Underwriters"—in the West .. 66
Celebrating its 50th anniversary, Underwriters' Laboratories reports to the Industry.

Preparing Planners for Postwar Homes 79
Pomona Institute is appealing to the home making instinct; giving outlet for dreams to be realized when the war is won.

Some Aspects of Postwar Rural Life 74
By H. B. Walker—An appraisal of rural electrification opportunities in California after the war.

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New Products 22
Bulletins 44
Electra 46
Engineering 51
Lighting and Wiring 66
Rural 74
Sales 79
Editorials 82
News 92

Cover: A picture map showing the Pacific Northwest states.

Preview

No Secret

should be made of the postwar program of the electric utilities, thinks the writer of a leading article in the next issue. He tells why by reviewing many of the public relations aspects of postwar planning.

Non-Metallic

in the extreme is the wiring installation in a huge hanger assembly plant of a southern California airplane manufacturer. Novel technique was developed for handling the lighting in this high-bay building so as to provide for relamping and maintenance. It will be described next month.

Reduced Margins

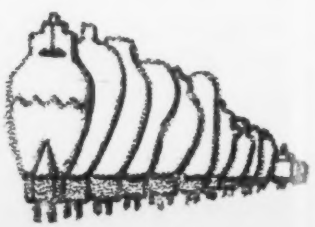
have been talked about in relation to appliance merchandising after the war. A utility executive got to thinking about the effect of such a policy and quizzed a prominent manufacturer about it. The answer was enlightening and ELECTRICAL WEST thinks you will be curious to hear both sides of the argument in the next issue.

Association Value

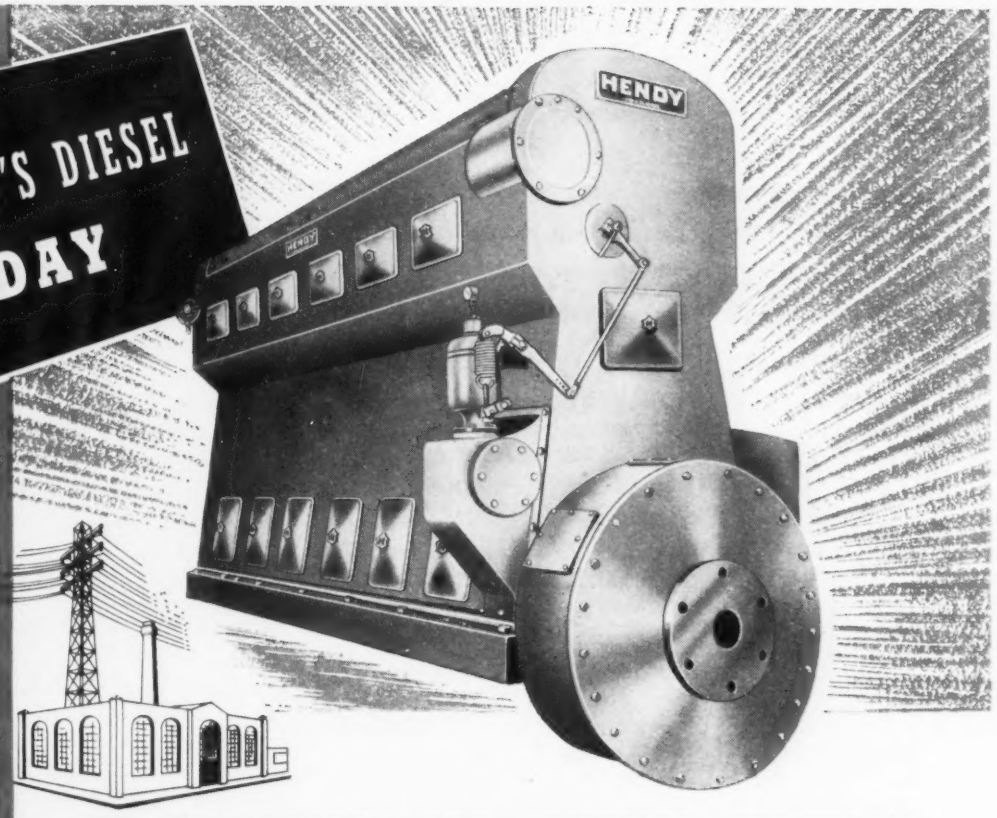
is well appraised in a brief talk which the president of a Western electrical contractors' association gave to his members at a recent meeting. It contains thoughts which should help other associations to plan their affairs to better advantage.

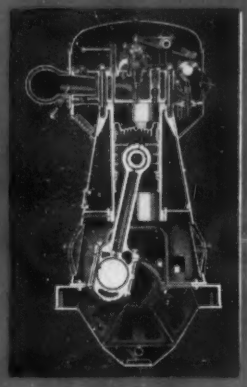
In Engineering

there will be an article on determination of field winding temperatures of synchronous machines by a member of the Hawaiian Electric Co. The section also will include the fifth article in the series, *Electronics at Work in Industry* and other features.



TOMORROW'S DIESEL TODAY





GENERAL SPECIFICATIONS
SERIES 50

Bore—12"; Stroke—15"
Speed—350 to 600 RPM
Rated Power at 450 RPM—
75 hp. per cyl.

Write for complete data on the Hendy Series 50 Diesel Engine

HENDY DIESELS FOR CENTRAL STATIONS

Twenty-two valuable design and construction features, never before combined in any single engine, have been incorporated in four-cycle Hendy Diesels—to lower your operating and maintenance costs, and prolong engine life. More than a half century of power plant experience is reflected in Series 50 Hendy Diesel Engines . . . which fully utilize the latest developments in engineering and metallurgical practices.

Here are typical features that make Hendy Diesels particularly suitable for central station service:

UNIT TYPE FUEL PUMP AND INJECTORS eliminate long, high-pressure fuel lines and improve engine performance.

DUAL INTAKE AND EXHAUST VALVES are operated by a cross-head which eliminates side thrust from the rocker arms.

POSITIVE, AUTOMATIC LUBRICATION throughout engine.

DESIGN OF WELDED STEEL engine bed and cylinder block assures strength and rigidity . . . reduces weight.

OIL-COOLED PISTONS lower piston temperatures, prolong ring and cylinder life, reduce oil consumption.

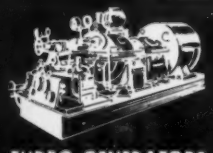
JOSHUA HENDY Division

JOSHUA HENDY IRON WORKS

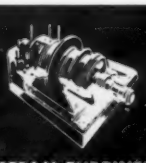
ESTABLISHED 1856

SUNNYVALE, CALIFORNIA

BRANCH OFFICES: Boston · Buffalo · Chicago · Cincinnati · Cleveland · Detroit · New York · Philadelphia · Pittsburgh · San Francisco · St Louis · Washington · Los Angeles


TURBO-GENERATORS

REDUCTION GEARS


STEAM TURBINES

DIESEL ENGINES

What's ahead for the

ALREADY THE MERCURY ARC RECTIFIER HAS WON ITS SPURS...

AMERICA'S HUGE AIRPLANE LIGHT METAL PROGRAM. TOMORROW

☛Biggest electronic device now in operation is the mercury power arc rectifier, converter of alternating current to direct current, first successfully introduced to America by Allis-Chalmers engineers.

When built to handle 4,000 kw, it stands 9 feet high, measures more than 8 feet across.

No laboratory models, these giant Allis-Chalmers tubes are vital production tools which were placed in electrolytic plants right after Pearl Harbor to process magnesium and aluminum in big, new wartime quantities needed; they helped accomplish one of the critical industrial feats of the war -- unprecedented expansion of U. S. light metal production, when it was most desperately needed.

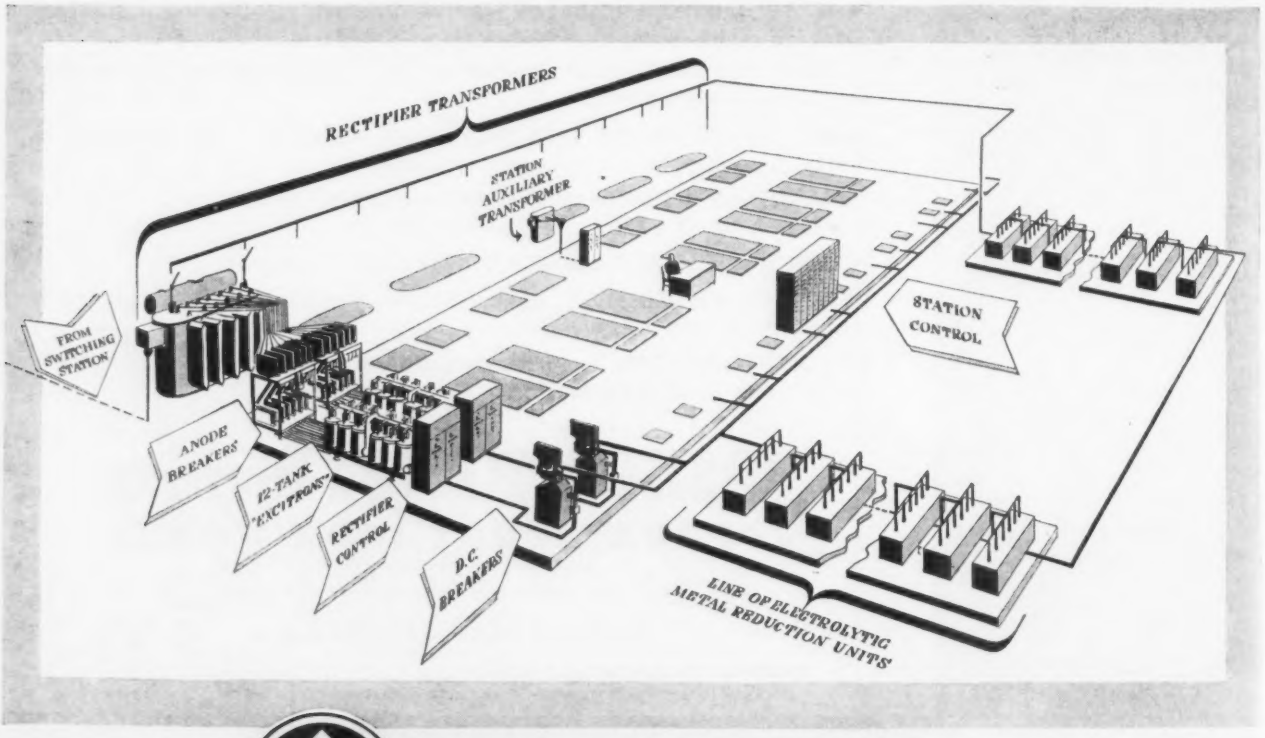
Latest trend in rectifiers is toward smaller units and lower voltages for wider application within industry.

In place of one big multi-anode tank, new units are divided into smaller chambers -- each having its own anode and mercury cathode. Result: manufacturing is simplified, conversion efficiency is greater because arc travel is short with lower arc loss.

Outstanding feature of Allis-Chalmers single-anode Excitron rectifier is "continuous excitation". When rectifier is connected to line, small solenoid plunger device under mercury pool squirts mercury spray to excitation anode, momentarily closing excitation circuit.

When spray collapses, small d-c pilot arc is established which remains as long

TYPICAL LAYOUT OF MODERN ELECTROLYTIC METAL-REDUCTION PLANT EMPLOYING RECTIFIERS

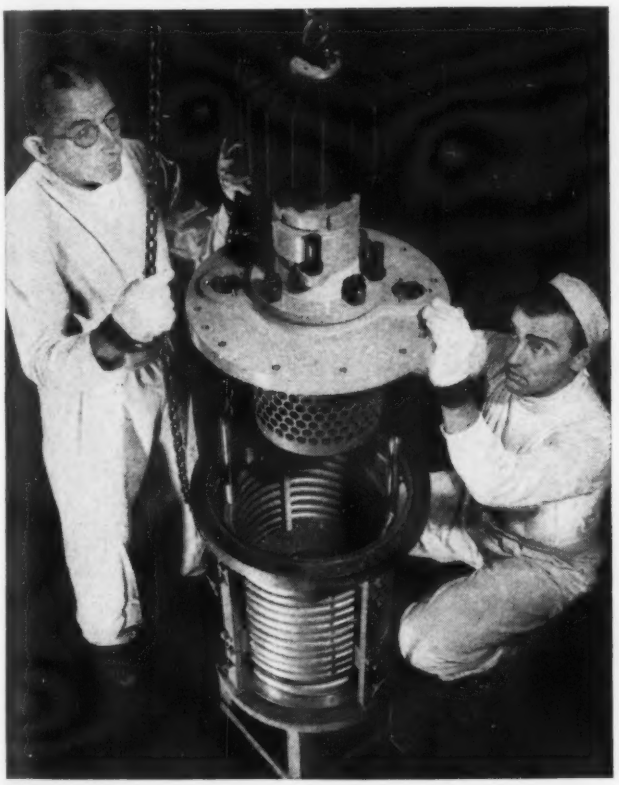


WE WORK FOR VICTORY WE PLAN FOR PEACE

ALLIS-

new Electronic Giant?

SUPPLYING THE FLOOD OF D-C POWER NEEDED TO ACCOMPLISH IT MAY REVOLUTIONIZE LONG DISTANCE POWER TRANSMISSION.



LOWERING ANODE ASSEMBLY INTO EXCITRON TANK

as rectifier operates, keeps Excitron tank continuously primed to fire when main anode voltage permits.

In operation and performance this big forward step means: 1) no need to synchronize ignition impulses with main anode voltage. 2) No need to tune the circuit or maintain proper wave shape. 3) Firing anode mounting is fixed, not critical as to location. 4) No need for external adjustment or special maintenance after installation.

Engineers looking ahead see the mercury arc rectifier as an important step toward long-distance d-c transmission...

Reasons that argue for future use of d-c are: 1) Greater line stability because d-c follows simple Ohmic Law. 2) Low line losses. 3) Better utilization of line insulation. 4) Receiving frequency independent of generating frequency.

More development must be done before long-distance d-c becomes practicable, but already first steps have been taken... electronic frequency changer is now in commercial operation, carrying a substantial load, changing power of one frequency to power of another frequency through flexible d-c link . . . prime example of short-distance d-c power transmission at moderate voltage.

Note other places Excitron rectifiers can be used: electric railways, electrolytic plants, steel mills, mine haulage systems.

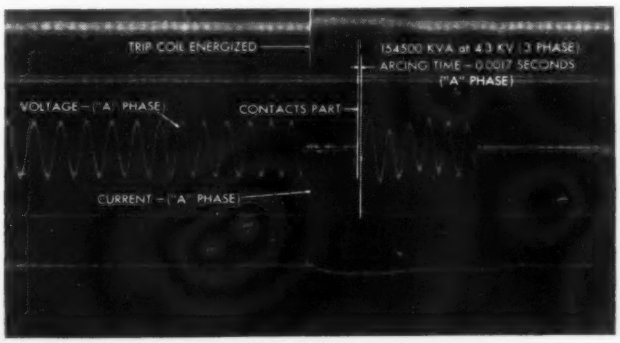
War's demand for higher efficiencies is giving new prominence to Allis-Chalmers air blast circuit breakers.

Reason: Arcing time of air blast breaker is always less than 1/2 cycle... that is, at the next current-zero of the 60 cycle wave after contacts part, arc is "out" to stay. Contact life is amazing ...protection is complete.

Look for other important new developments in electrical and power equipment from Allis-Chalmers. Maybe we can help you -- maybe you can help us. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

A 1701

OSCILLOGRAM OF AIR BLAST INTERRUPTION

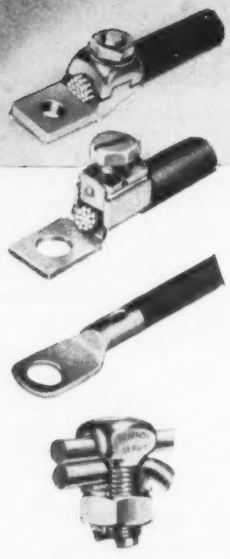


CHALMERS

Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.

NERVE CENTERS... *in fox holes*

Official photo, U. S. Marine Corps



• In these front line communication centers, too, Burndy Connectors play an important role. In stringing wires, for example, where the split-second is vital in making *sound* connections, the popular **SERVIT** is used. For equipment connections, **SCRULUGS, QIKLUGS, HYLUGS** and other Burndy types are extensively employed.

Likewise in our fighting aircraft; on ships, tanks and other electrified war equipment, vital electrical connections are made the **BURNDY** way . . . with the same *speed, efficiency* and *security* which have kept Burndy connectors *leaders* for all peacetime needs.

Burndy Headquarters for CONNECTORS

BURNDY ENGINEERING CO., INC., 107 Eastern Boulevard, New York 54, N. Y.

IN CANADA: Canadian Line Materials, Limited, Toronto 13

PREPARE NOW FOR SUMMER SERVICE

BETTER CARE Electric Refrigeration LESS REPAIR

Kelvinator's Popular Service Training Program Again Made Available to the Entire Industry.

In the coming third summer of war, servicing electrical appliances will be a bigger problem than ever.

Recognizing the importance of this problem . . . and in cooperation with the National Appliance Conservation Program . . . Kelvinator offers to the industry its three-point wartime refrigerator service program. Retailers called it the most valuable help of the year in meeting service problems of 1943.

First—The "Simplified Training Course for Refrigerator Service Men"—a complete 236-page book for quickly training men or women in the fundamentals of servicing any make refrigerator. Thousands of copies of this training course have been used by retailers, utilities and technical schools in training new people. With this is an "Instruction Manual" for use in group training.

Second—The "Trouble Shooter's Guide." a ready reference on the cause and correction of common customer complaints. With this, most operating troubles . . . regardless of make of refrigerator . . . can be quickly diagnosed and corrected. Especially prepared for new or inexperienced service men, it proved last year to be extremely helpful also to old-timers.

Third—The "Refrigerator User's Guide"—A completely new trouble shooter's guide for home use, it tells what must be done to keep a refrigerator operating efficiently—how the user can diagnose minor troubles and make proper adjustments and repairs at home until a trained serviceman is available.

This material is made available by Kelvinator to all those in the industry that provide service to refrigerator users, in a sincere effort to make a worthwhile contribution to the solving of a most vital wartime problem.

To control distribution, a nominal 25¢ charge is made for the 236-page "Training Course" and a 5¢ charge is made for the "Trouble Shooter's Guide." The "User's Guide" is available at no cost in conservative quantities to recognized refrigerator retailers and service organizations.

For complete information, contact your local Kelvinator Distributor or Zone Office.

The men and women of the Propeller Division of Nash-Kelvinator Corporation have been awarded, and proudly fly and wear, the famous Army-Navy "E" for High Achievement in War Production.

LOOK AHEAD WITH KELVINATOR
DIVISION OF NASH-KELVINATOR CORPORATION
Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing

Westinghouse reports

to the Lighting Industry . . .

Predictions about tomorrow are plentiful. But in order to plan, you need more than predictions, you want the facts. Here, then, are the simple facts about tomorrow's Fluorescent Lamps, straight from Westinghouse designers, engineers and research men.

YOU WILL HAVE CIRCULAR FLUORESCENT LAMPS

Dimensions have been worked out, as indicated on the opposite page.

YOU WILL HAVE LONG, THIN FLUORESCENT LAMPS IN NEW SHAPES AND SIZES

Dimensions have been worked out, as indicated on the opposite page.

These new Fluorescent developments, pressed forward by Westinghouse research, will provide the Lighting Industry with a remarkable opportunity for expansion. They will bring Fluorescent light into the home—in portable lamps and new fixtures

☆ FOR LEADERSHIP IN LIGHTING . . .

ABOUT TOMORROW'S FLUORESCENT LAMPS

that meet accepted standards of decoration and good taste.

They will open up new merchandising opportunities for stores, theaters, restaurants, hotels, office buildings, transportation terminals and other commercial enterprises.

We cannot tell you when these new lamps will be available, for Westinghouse manufacturing facilities are still heavily engaged in war work. But we will advise you as to their availability as far in advance of production as possible.

One more fact about tomorrow's Fluorescent Lamps. You can be sure that the Westinghouse name on a lamp will continue as a pledge of quality and dependability—assured by persistent Westinghouse research and engineering know-how.

Westinghouse Elec. & Mfg. Co., Bloomfield, N. J. Plants in 25 cities . . . offices everywhere.

WESTINGHOUSE MAZDA CIRCULAR FLUORESCENT LAMPS *Sizes to be produced and current consumption*

Approx. Overall Outside Diam. of Circle	Maximum Tube Size	Approx. Watts
8½ in.	1¼ in.	20
12¼ in.	1¼ in.	30
16 in.	1¼—1½ in.	40

WESTINGHOUSE MAZDA LONG THIN FLUORESCENT LAMPS *Sizes to be produced*

Length Including Sockets	Approx. Tube Diameter
5½ ft.	½ in.
5½ ft.	¾ in.
5½ ft.	1 in.
7½—8 ft.	¾ in.

. WATCH **Westinghouse**

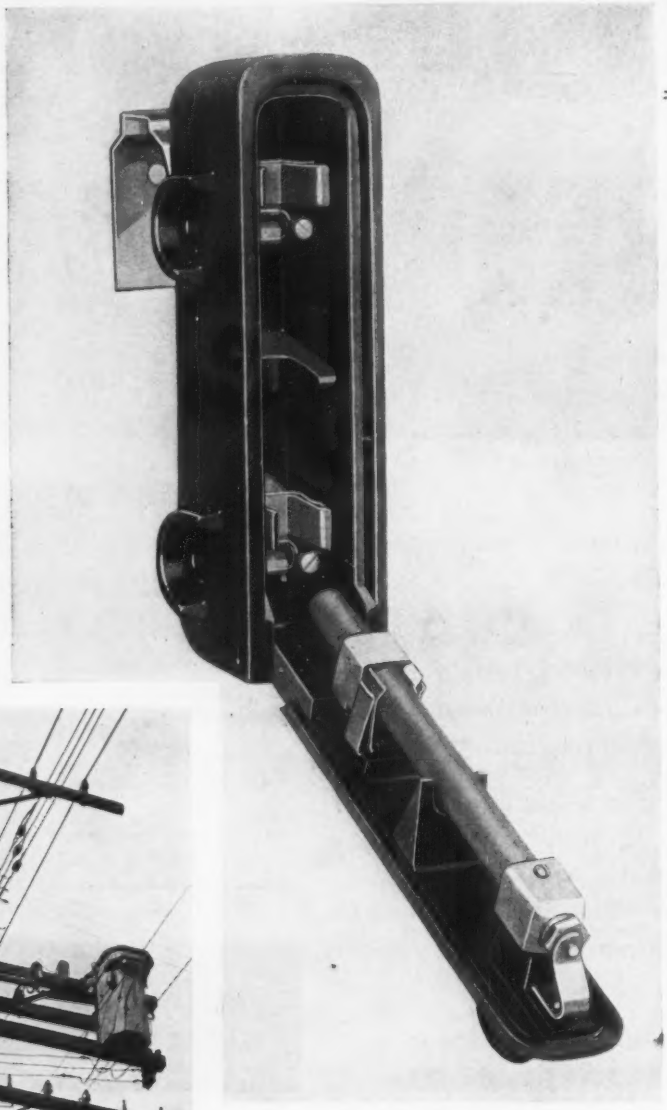
MAZDA LAMPS FOR SEE-ABILITY

CONSERVE VITAL MATERIALS WITH

NON-INDICATING, PORCELAIN-HOUSED MATTHEWS CUTOUTS

RATINGS
50 and 100 Amperes
5 and 7½/12½
Kv Grd. Y

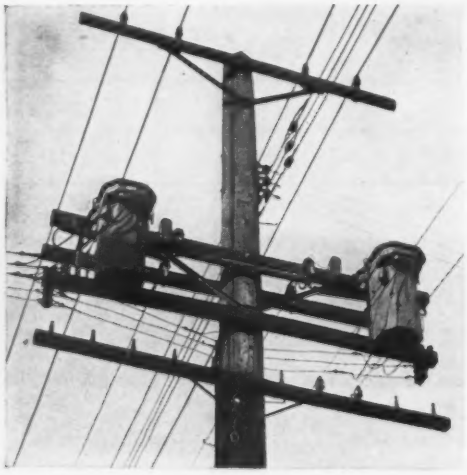
INTERRUPTING CAPACITIES
1200 and 3000 Amperes



Catalogs 950 and 956
(Interior detail same in all sizes)

Catalog 650

Catalog 850



Shows two single phase 4400 volt installations of Catalog 650 Matthews Cutouts.

Simple, sturdy design conserves vital war materials and man power by eliminating moving parts but without sacrificing electrical and mechanical efficiency.

For complete details
Write for Bulletin 103

WHY THEY ARE LIKED

Simple —Rugged — No Moving Parts — Heavy Everdur Set Screws — All Current Carrying Parts Over 85% Copper Content —Time-seasoned Bakelite Covered Fibre Fuseholder Tubes Which Won't Warp — High Flashover Values — High Interrupting Capacity — Lowest Time-cost — Over 400,000 In Use. No essential changes in design in over fifteen years, but many refinements have been made. Price is lower than for indicating type.

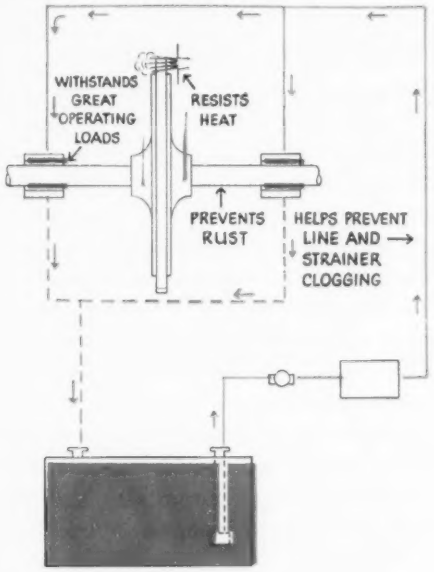
W. N. MATTHEWS CORPORATION
SAINT LOUIS, U. S. A.
ENGINEERS and MANUFACTURERS SINCE 1899

STANDARD ENGINEERS NOTEBOOK

VOL. I-E NO. 1

Rust-inhibited turbine oils solve many maintenance problems

Full protection against rapid deterioration of turbine oil charges and assurance against rusting turbine parts, may now be obtained by specifying Calol Deturbo 19X.



Developed for double reduction geared steam or land turbines, Calol Deturbo 19X is a product of carefully segregated crude, manufactured to perfect its natural ability to separate rapidly from water with a minimum of sludge formation, and especially compounded to protect all metal surfaces from corrosion – particularly the delicate moving parts of the governor.

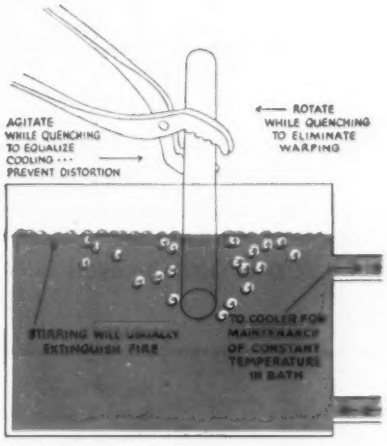
Calol Deturbo 19X has a viscosity of approximately SAE 30. It has been officially approved by the United States Navy.

Rapid cooling rate oils for alloy steels

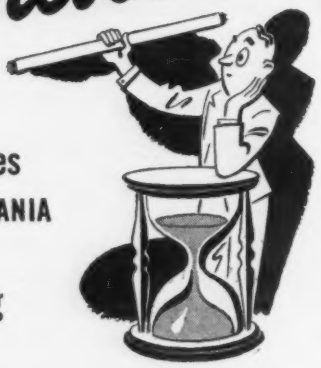
Proved in actual plant tests to possess superior hardening qualities, Calol Alloy Quenching Oil is especially compounded to provide a much faster cooling and hardening rate. To accomplish this, Standard of California scientists have employed what we believe is an entirely new principle. With this new type oil, allcy steels can be treated to consistently higher hardness.

Where a lower cooling rate is desired for high carbon steel, the use of Standard's (all-purpose) Calol Quenching Oil is recommended.

Both of these oils are for use in circulating or non-circulating systems. They may be added to other types of oil.


AGITATE WHILE QUENCHING TO EQUALIZE COOLING ··· PREVENT DISTORTION
ROTATE WHILE QUENCHING TO ELIMINATE WARPING
STIRRING WILL USUALLY EXTINGUISH FIRE
TO COOLER FOR MAINTENANCE OF CONSTANT TEMPERATURE IN BATH

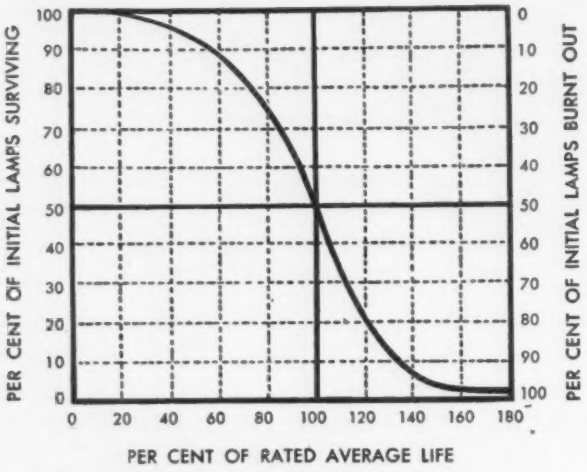
Fluorescent operating hints



No. 2 of a series published by SYLVANIA for all users of fluorescent lighting

HOW TO GET FULL LAMP LIFE

Average rated life of good-quality fluorescent lamps is 2500 hours for the 40-watt size — 3000 hours for the 100-watt size. But the life of individual lamps may vary as the chart shows:



And actual operating conditions seldom are as favorable as controlled laboratory tests. Nevertheless, these average rated life figures will help you estimate how many lamps you will normally replace every month. Simply use 2500 or 3000 hours as indicated in this formula:

$$\text{Expected lamp renewals per month} = \frac{\text{No. of lamps} \times \text{average burning hours per month}}{\text{Rated average life of lamps in hours}}$$

If your actual monthly replacements consistently exceed the calculated figure in your own formula, it will pay you to check these five factors, which shorten lamp life:

1. TOO FREQUENT STARTING: Average rated life is based on lamps operating for not less than four hours every time they are started. More frequent starting dissipates the filament coating vital to fluorescent performance — and thus shortens lamp life.

2. DEFECTIVE STARTERS: Starters that are not working properly may cause the lamp to blink off and on, a condition that also shortens lamp life. Sylvania Starters cost only a few cents and should be replaced as necessary to protect your lamp investment.

3. VOLTAGE VARIATIONS: Fluorescent lamps are made to operate within specified *ranges* of voltage — for example, 110-125 volts. Variations within the specified voltage range do not seriously affect a lamp. But at voltages much below the range, starting becomes uncertain, and there is an excessive drain on electrode material — with a resultant toll on lamp life. Above the normal range, there is also a life-shortening effect. In addition, light output also is affected by voltages outside the normal range.

4. LOW TEMPERATURE: Fluorescent lamps are designed to operate most efficiently between 60 and 90 degrees Fahrenheit. If low temperatures are unavoidable, lamps may be protected with enclosed fixtures.

5. EXCESSIVE VIBRATION: This reduces lamp life and can often be prevented or minimized.

For Additional Maintenance Information

Send for this Free Booklet

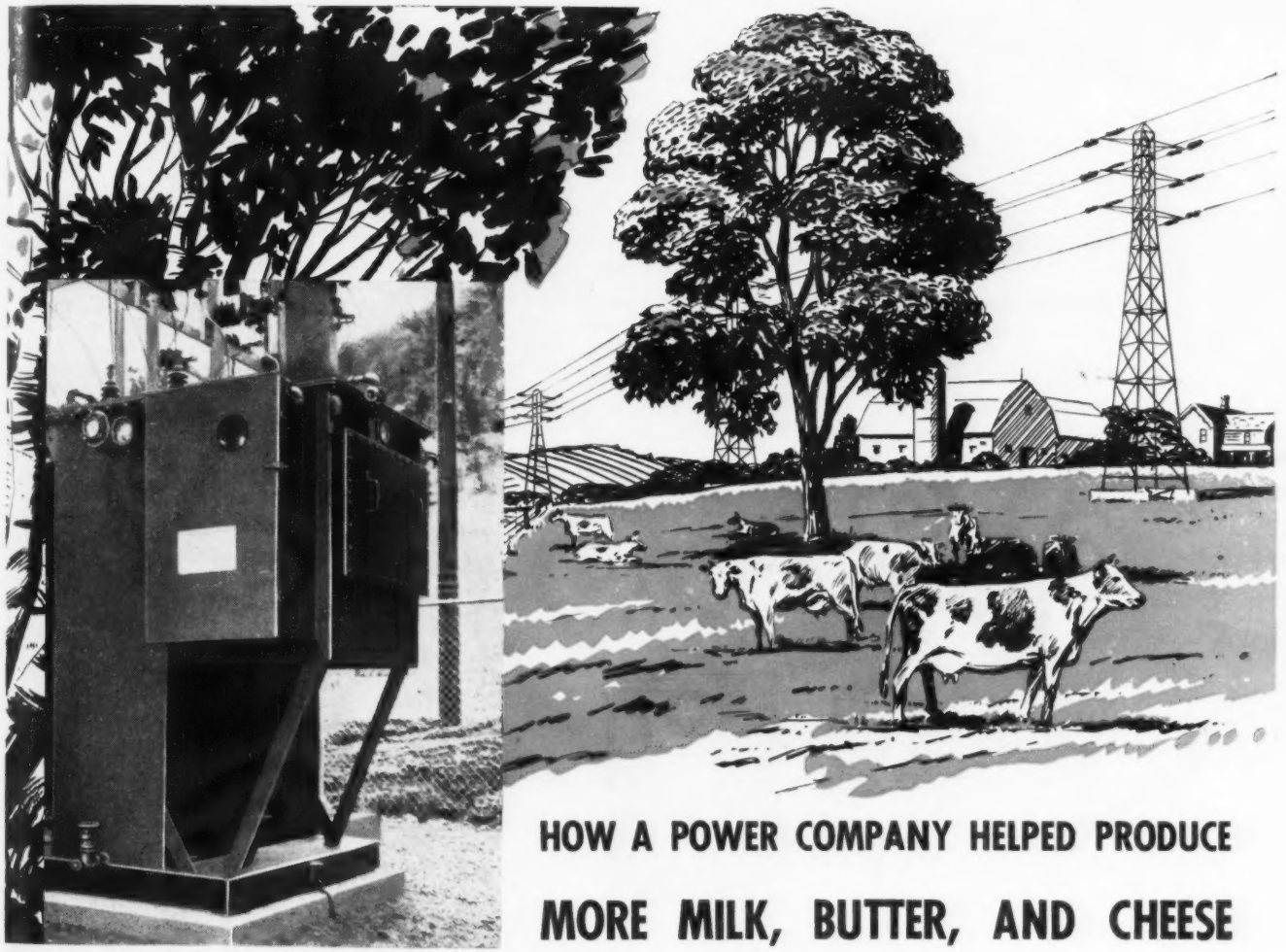
100,000 already distributed

SYLVANIA ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES



HOW A POWER COMPANY HELPED PRODUCE MORE MILK, BUTTER, AND CHEESE BY MEANS OF A *VOLTAGE REGULATOR*

PROBLEM

A New York State power company, serving one of the greatest milk producing counties in the United States, was faced with the problem of supplying additional power to dairy plants in this area. A great increase in load had developed because of the additional electrified equipment installed to meet the overwhelming wartime demand for milk and milk products. This power demand had to be met *in a hurry* with little change in the power company's facilities, and with the use of as little critical material as possible.

SOLUTION INCLUDED THE USE OF A G-E STEP REGULATOR

A standard G-E 300-kva, three-phase, 6900/12,000Y-volt step regulator proved to be the key to the solution. It was the only new equipment required to lick the problem. By redistributing the load among the substations supplying the area; by making use of a spare bank of transformers; and by correcting, by means of the step regulator, the poor regulation on a 6900-volt feeder, where peak loads persisted for six hours daily, it was possible to meet the new load demand *quickly* and without the necessity of new transmission facilities.

IF YOU NEED ADDITIONAL CAPACITY . . .

. . . better regulation may be your answer, too. Feeder regulators make possible more effective use of equipment on a system. Loads can be evenly distributed between substations or interchanged on tie lines; kilowatts, kilovars, and phase angle can all be controlled. Additional capacity can be released for new loads with huge savings in time, money, and critical materials.

Ask your G-E representative to estimate the benefits of feeder regulators on your system, or write for Bulletin GEA-2762. *General Electric Co., Schenectady, N. Y.*

FEEDER VOLTAGE REGULATORS

One of a series telling of wartime distribution problems being solved with G-E feeder voltage regulators — applications where they saved critical materials or otherwise helped the war effort, like some jobs you may have.

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

GENERAL ELECTRIC

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If you sold PROCTOR Automatic Electrical Appliances before the war...

... NATIONAL ADVERTISING

HELPED YOU SELL. Today with "nothing to sell," Proctor continues its national advertising. When Victory comes, your customers will know the Proctor name better than ever . . . and more than ever, they'll want Proctor products!

TOMORROW...

You'll want to sell the Proctor Appliances for which, right now, this advertising is already building up demand. Meanwhile let's all *"Back the Attack"* with War Bonds.

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NEWSMAKERIN APPLIANCE MERCHANDISING

PROCTOR ELECTRIC COMPANY—*DIVISION*, PROCTOR & SCHWARTZ, INC.
PHILADELPHIA 40, PENNSYLVANIA.

BOOKS

you may want

SHORT-WAVE WIRELESS COMMUNICATION, including Ultra-Short Waves by A. W. Ladner and C. R. Strong, fourth edition, 573 pages, index, appendix, 342 illustrations, 5¾x8½, John Wiley & Sons, $6. This book is a treatise on short-wave wireless communication by British authors. It reviews the progress of early wireless development, tracing through the years the important changes that have taken place. The material within the book is arranged in logical order, describing various methods of obtaining modulation of high frequency waves, the uses of such modulation equipment, and the effect of suppressing side bands. The chapter entitled *Propagation of Short Waves* is particularly well written and the material is arranged in a popular informal way. Mathematics are kept to a minimum except where necessary to clarify the text.

High-frequency feeders and aerial arrays are given good treatment and the material has been carefully selected. Other chapters include descriptions of push-pull arrangements, oscillators, and the methods used to obtain constant frequency oscillations. An entire chapter is devoted to the electron type of oscillator, its theory and commercial practices. Such oscillator valves as the Magnatron, Dynatron and Klystron are described. Other chapters contain material discussing problems of reception, commercial receivers and high frequency therapeutic apparatus.

An appendix is included, which gives propagation curves for wave lengths of 2, 4 and 6 meters; optimum wave length for communication over distances 500 to 5,000 kilometres; calculation of the characteristic resistance of feeders from dimensions; feeder theory when R and G are allowed for and valves for short and ultra-short waves.

This book covers the entire short-wave spectrum as far as basic theory and applications are concerned, the material is written in an interesting, non-mathematical manner and is British in its terminology and descriptions. It is a valuable book for the student and the engineer engaged in short-wave wireless.—F. S. B.

FUNDAMENTALS OF TELEPHONY, by Arthur L. Albert, professor of communications engineering, Oregon State College, 374 pages, 5½x8½, illustrated, McGraw-Hill Book Co., $3.25. In this carefully written and excellently printed book, which appears small on account of the wartime economy format, the author has presented in compact form a surprisingly complete statement of the fundamentals of telephone lines and equipment from the standpoint of electrical behavior with numerous descriptions and illustrations of typical equipment. Although it is stated to be largely a condensation from the author's more elaborate earlier texts, the consistency of treatment indicates thorough rewriting under a well organized plan.

While intended for beginning students and telephone workers, it should prove a convenient reference and guide for engineers and others interested in a general survey. Much of the conciseness is due to the omission of derivations of mathematical formulas; adequate explanation is made, however, of the basic considerations. Numerous problems are worked out with clear illustrative figures to demonstrate the handling of the formulas.

(Continued on Page 18)

CENTRAL RIGID STEEL CONDUIT

"There's Tested Strength in Every Length"

Protection-

for you and your customers

• When *you* use Central Rigid Steel Conduit—or incorporate it in your product—you are protecting both yourself and your customers.

And because this high quality product serves so well, so economically—and for so many years, *you are protecting your own business future.*

We believe that hundreds of manufacturers and electrical contractors will agree with that statement.

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NORGE "Line" for '44

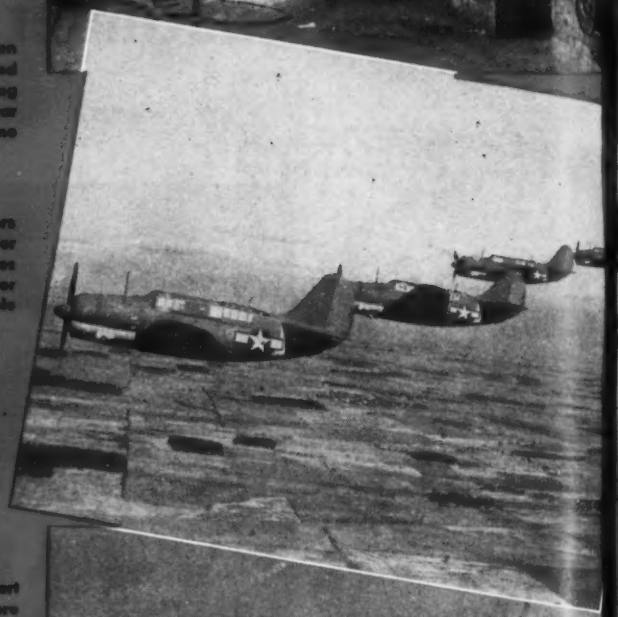
Largest and most spectacular we have ever offered!

The engineering skill and precision workmanship required to build intricate products to Army and Navy specifications illustrate the flexibility of the Norge manufacturing operations. The fact that Norge can produce so many and such a variety of products augurs well for the peacetime production of home appliances. The new knowledge, skill and techniques acquired while working for Uncle Sam will be reflected in the postwar products made available to Norge dealers when peacetime production is resumed.

Left: Camouflaged marines approach their objective in a landing boat equipped with marine transmission built by Norge. (Official U. S. Navy photograph.)

Right: A battery of Norge-built transmissions being tested on landing craft engines.

Left: Norge has been awarded the coveted Army-Navy "E" flag "for outstanding war production." To date one star has been added.



Right: Curtiss Helldivers in flight formation. For these famous planes Norge builds carburetor air scoops and flexible gun turrets.

Left: Lt.-Comm. Robert B. Kelly of "They Were Expendable" fame on the deck of a PT boat equipped with gun mount of a type built by Norge. (Official U. S. Navy photograph.)

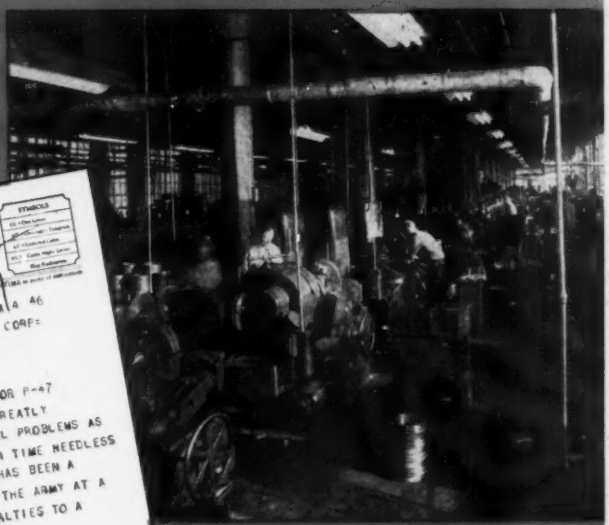
Right: U. S. Navy PT boat. Norge builds .50-cal. twin machine gun turrets for similar craft. (Official U. S. Navy photograph.)

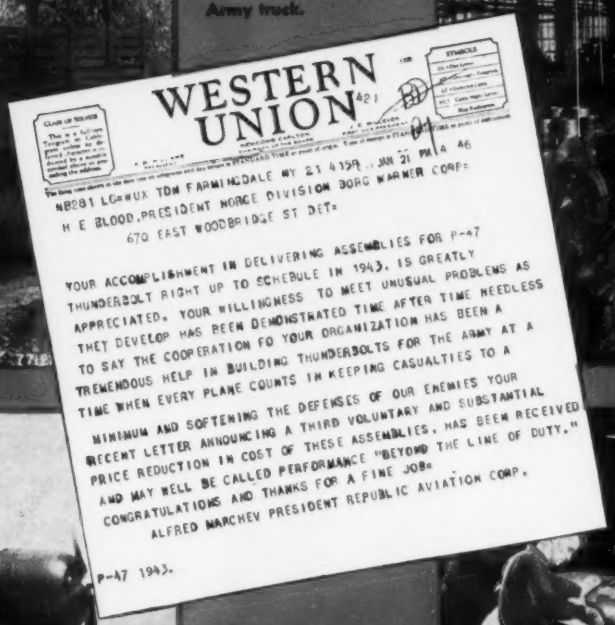
Left: Marines grab a bite during a lull in battle. Mounts for this 20-mm. anti-aircraft gun are made at Norge. (Official U. S. Navy photograph.)

Right: Castings at the Norge plant prior to machining into pedestals for Mark IV Oerlikon gun mounts.

Left, below: Transmission gears for this 1½-ton Army truck (Ford) are among the 40-odd war items made by Norge.

Right: In this Norge plant are machined the transmission gears used in the Ford 1½-ton Army truck.





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H E BLOOD,PRESIDENT NORGE DIVISION BORG WARNER CORP=
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YOUR ACCOMPLISHMENT IN DELIVERING ASSEMBLIES FOR P-47 THUNDERBOLT RIGHT UP TO SCHEDULE IN 1943, IS GREATLY APPRECIATED. YOUR WILLINGNESS TO MEET UNUSUAL PROBLEMS AS THEY DEVELOP HAS BEEN DEMONSTRATED TIME AFTER TIME NEEDLESS TO SAY THE COOPERATION FO YOUR ORGANIZATION HAS BEEN A TREMENDOUS HELP IN BUILDING THUNDERBOLTS FOR THE ARMY AT A TIME WHEN EVERY PLANE COUNTS IN KEEPING CASUALTIES TO A MINIMUM AND SOFTENING THE DEFENSES OF OUR ENEMIES YOUR RECENT LETTER ANNOUNCING A THIRD VOLUNTARY AND SUBSTANTIAL PRICE REDUCTION IN COST OF THESE ASSEMBLIES, HAS BEEN RECEIVED AND MAY WELL BE CALLED PERFORMANCE "BEYOND THE LINE OF DUTY." CONGRATULATIONS AND THANKS FOR A FINE JOB=
ALFRED MARCHEV PRESIDENT REPUBLIC AVIATION CORP.

P-47 1943.

Left: The famous Republic P-47 Thunderbolt, for which Norge makes bottom cowl and exhaust shroud assemblies.

Right: After fighting Japs on New Guinea for 20 months, one of these men now helps build the belly cowl for the P-47 Thunderbolt in the Norge plant.

Above are just a few of 40 important war assignments of

NORGE

A BORG-WARNER INDUSTRY

NORGE DIVISION, BORG-WARNER CORPORATION, 670 EAST WOODBRIDGE ST., DETROIT 26, MICH.

Only prewar producer of a complete line of ROLLATOR REFRIGERATORS ★
ELECTRIC RANGES ★ WASHERS ★ GAS RANGES ★ HOME HEATERS ★ COMMERCIAL REFRIGERATION

LINEMEN ARE KLEINMEN
IN THE SERVICE AND OUT

Back home, one contribution we can make to speed Victory is the conservation of tools and equipment. To help in this important job, Klein has prepared an illustrated pocket manual on the care and correct use of tools to assure their long life. A copy will be sent to anyone interested.

Today Klein Pliers are winning new friends among men whose tough jobs make quality pliers a necessity. When they return to peace-time occupations, many thousands of men who are in the armed forces, or who are engaged in the manufacture of war material, will have the same high regard for Klein tools that good workmen everywhere have had for almost a century.

Meeting the demands of the Army, the Navy and essential industry is keeping the Klein plant busy, producing the tools so necessary to victory. No conversion or change will be needed to transform this production to peace-time needs as soon as the war is won. For Mathias Klein & Sons are today producing the tools they have always made—only more of them.

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KLEIN TOOLS EST. 1857

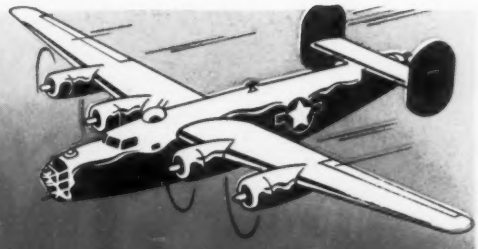
The choice of review questions and problems indicates the acquaintance of the author with commercial circuits and systems. The importance of room noise, transmission band-width, and articulation in affecting telephone transmission is recognized in a chapter devoted to sound, speech and hearing. In chapters such as those on telephone repeaters and carrier systems, inductive coordination, dial telephone systems, and measurements, the technical terminology of the art is effectively presented; thus, the book should serve as an excellent preparation for making effective use of the very extensive information contained in operating instruction books, equipment catalogs, more advanced texts, and current magazines.—D.I.C.

MAINTENANCE AND SERVICING OF ELECTRICAL INSTRUMENTS, by James Spencer, 256 pages, 274 illustrations, 5x8¼, bound in fabricoid, Instruments Publishing Co., Pittsburgh, Pa., $2. In a war of machinery, instruments keep the human operator informed as to the multitude of operating conditions within these machines. Industry long ago found that out, but war is making far greater use of instruments than at any previous period. There had been, however, no simple book on the maintenance and servicing of electrical instruments. The tremendous increase in use of instruments plus the necessity to train manpower to handle and repair them brought forth the present volume. It was developed very generally from class notes by the author for teaching in trade schools. It covers general types of instruments in all classes, simple explanations of underlying principles of operation, then detailed instructions on maintenance and repair. It is useful both for essential instruments used in industry and in combat instruments employed by both Army and Navy.

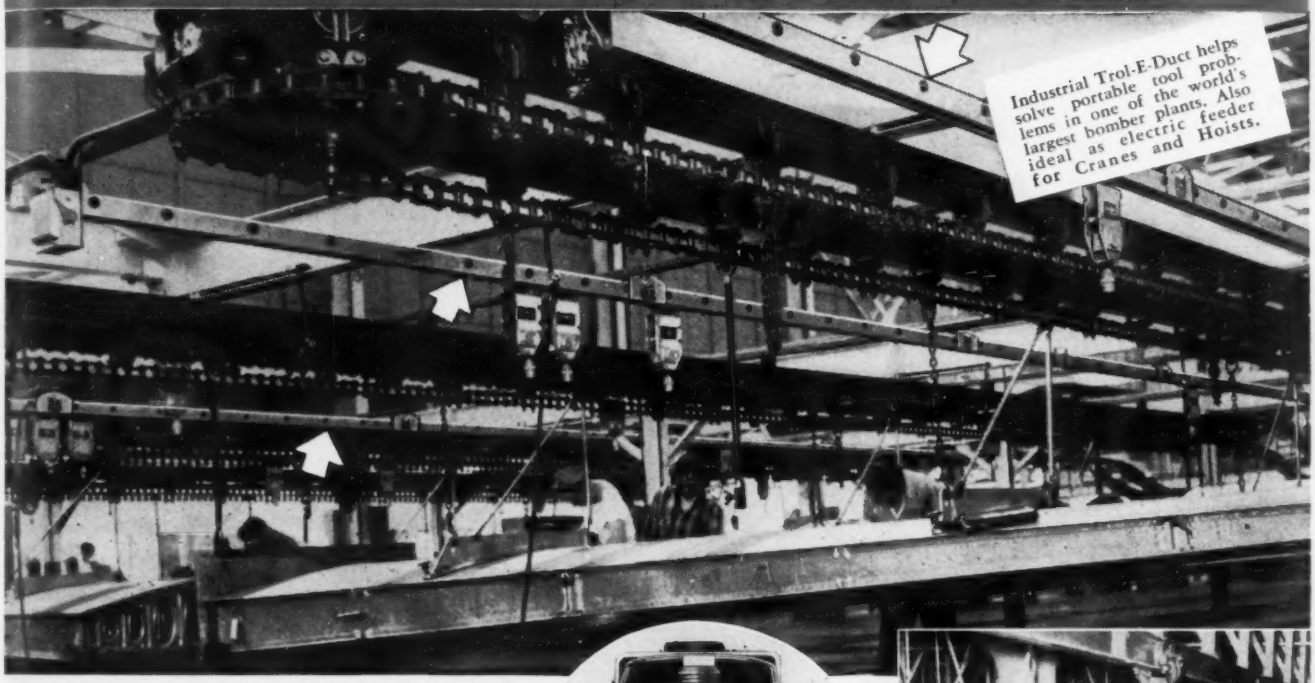
BASIC RADIO PRINCIPLES, by Captain Maurice Grayle Suffern, 271 pages, index, well illustrated with circuit diagrams and drawings, 5½ x 8, McGraw-Hill Book Co., $3. This book departs from current text practice in that it contains no mathematics, formulas or graphs. Simple circuit diagrams and drawings serve as illustrations to clarify principles. A quiz at the end of each chapter should aid the student in picking the important principles explained. The book is intended primarily for those who desire basic principles of radio that will equip them with the knowledge necessary to enter the radio field whether it be civilian, Civil Service or in the Armed Forces. In a sense the text constitutes an unabridged dictionary of radio circuits, equipment and devices that enhances its value and aids greatly in the book's accomplishing its purpose.—W.C.H.

FUNDAMENTAL RADIO EXPERIMENTS, by Robert C. Higgy, 95 pages, index, numerous simple circuit diagrams, 5½ x 8, John Wiley & Sons, $1.50. A laboratory manual suitable as a text giving 32 basic experiments designed to instill fundamental principles of electronic tube circuits and their applications in the field of radio communication. Greatest value of the text will come from performing each of the experiments, although considerable basic knowledge of the laws governing vacuum tube circuits may be gained by mere careful reading of book. A knowledge of high school mathematics and simple electrical theory is presupposed to derive greatest good from this well presented text.—W.C.H.

POWER FOLLOWS THE JOB



IN GREAT U. S. AIRCRAFT PLANTS


Industrial Trol-E-Duct helps solve portable tool problems in one of the world's largest bomber plants. Also ideal as electric feeder for Cranes and Hoists.

INDUSTRIAL TROL-E-DUCT BRINGS POWER CLOSE TO THE TOOL

In these days of fast-moving production lines and frequent changeovers, war plants must have a *movable* source of power for portable tools.

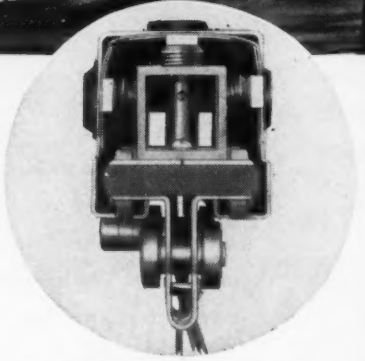
Only Industrial Trol-E-Duct can fully meet this need. Here, the source of power moves right along with the tool and the tool moves right along with the work.

Gone are the hazards and interruptions caused by fixed plug-in points. With Industrial Trol-E-Duct, safety goes up, production time goes down and extensive savings are effected in wiring and other fixed equipment.

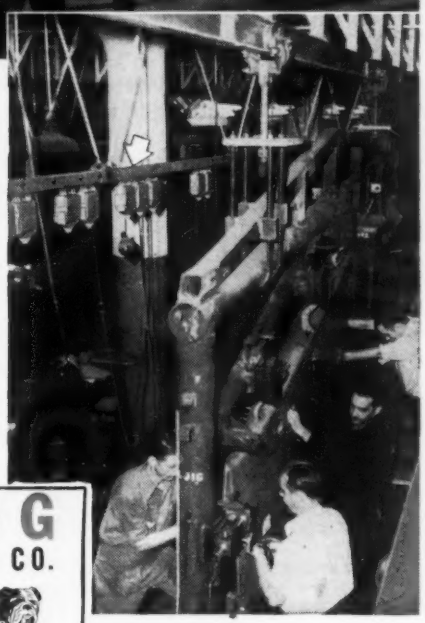
Because of its special enclosed design it is ideally adapted to crane and hoist applications in place of the dangerous open trolley wire.

Write for complete descriptive folder.

FOR A BRIGHT FUTURE BUY MORE WAR BONDS



BullDog's new "T" type sliding disc trolley conserves critical material without any sacrifice of operating effectiveness.



How power follows the tools in another big war plant building wings for combat planes.

BULLDOG
ELECTRIC PRODUCTS CO.
Box 177, R. Pk. Annex
Detroit 32, Michigan
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

In addition to its three famous lines of Bus Duct, BUStribution DUCT *for "plug-in" power,* Universal Trol-E-Duct *for flexible lighting* and Industrial Trol-E-Duct *for movable "loads,"* BullDog Electric Products Company manufactures a wide line of other products for power distribution and control, including Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers and Switchboards.

BULLDOG PRODUCTS ARE SOLD AND DISTRIBUTED BY THE FOLLOWING PACIFIC COAST REPRESENTATIVES:

Coast Electric & Manufacturing Co.
1720 N.E. Sixth Avenue
Portland, Oregon, Tel. Garfield 2844

Safety Switchboard & Manufacturing Co.
1445 Stevenson St.
San Francisco, Calif., Tel. Hemlock 2470

Mullenbach Electrical Manufacturing Co.
2300 East 27th Street
Los Angeles, Calif., Tel. Jefferson 2224

When the delivery date on an important Army order was suddenly pushed ahead, the builder found himself in *immediate* need of 200 switches of a special type.

Factory shipments couldn't meet the deadline, and no one in the area stocked switches of this unusual design. Then a GRAYBAR "procurement advisor" recalled that another local firm used a similar type of switch on its line of meat-chopping machines.

A borrowed sample showed that these switches would fill the bill – but all on hand were needed for a Navy order for meat-choppers! Luckily, production schedules at the latter plant left a little more leeway in time.

On Graybar's promise of prompt replacement, enough switches were "switched" to the *Army's* job to get it out on schedule. Then, fast work by GRAYBAR brought new switches to the Navy's supplier in time to avoid installation delay here!

If you build any ELECTRIFIED product . . . from a meat chopper to a 4-engined bomber . . . GRAYBAR can speed up and simplify the mobilization of electrical materials and parts to be built into it. A single call to a GRAYBAR "procurement advisor" ties you in to a network of over 80 warehouses, supplied from over 200 manufacturers.

(P. S. For your post-war distribution plans, keep GRAYBAR's *facilities in mind.)*

MOBILIZED MATERIALS No. 14 of a series of actual examples of GRAYBAR service, providing electrical materials to be installed in ships, planes and other war products.

GraybaR

IN OVER 80 PRINCIPAL CITIES

Executive Offices: Graybar Bldg., New York 17, N.Y.

GraybaR Everything Electrical .... THAT IT TAKES TO WIN!

PIPE LINE TO VICTORY

Up ahead the cluster of houses where the enemy had holed in crumbled. You could see the rubble flying high in the air and before the dust had settled could see other shells hit the mark.

Hunkered down in a shell hole, the observer pressed his lips closer to his phone's mouthpiece. "On target," he said . . . and his words went back across the rough terrain to the battery . . . came through clearly, distinctly.

That's because Laytex Assault Wire . . . made expressly for front line service . . . has a talking distance of better than five miles. It is a positive means of assuring clear, sure transmission of messages from reconnaissance posts to headquarters.

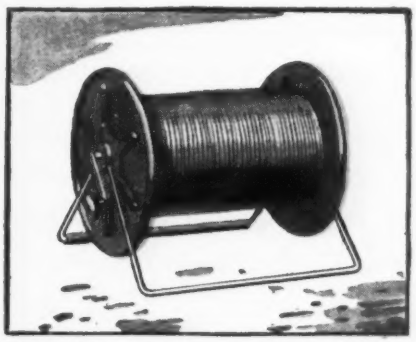
But talking distance is not the only advantage of Laytex Assault Wire. Its superior insulation makes possible its small diameter and light weight; a mile weighs less than 30 pounds. It has high resistance to moisture—can be unreeled over wet ground, through puddles and streams without affecting its efficiency. It is unaffected by temperature changes and does not become embrittled by concussion and shock

These same properties—light weight, small diameter, ability to withstand temperature changes, flexibility and toughness make other types of Laytex Wires and Cables as important in peacetime industry and building as to the Armed Forces.

Laytex **ASSAULT WIRE**

ON THE JOB IN ANY CLIMATE. Laytex Assault Wire was developed by United States Rubber Company scientists working in close cooperation with engineers of the Army Signal Corps.

LIGHT WEIGHT SAVES MANPOWER. One man carries enough wire to keep communications open. This is important—it not only releases men for other duties but also reduces the fatigue of men who are travelling hard and fast.



TALKING DISTANCE...OVER 5 MILES . . . Laytex Assault Wire assures clear, sure transmission of messages—a prime military requirement for battlefront communications.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

SERVING THROUGH SCIENCE TO BUILD A BETTER WORLD

UNITED STATES RUBBER COMPANY

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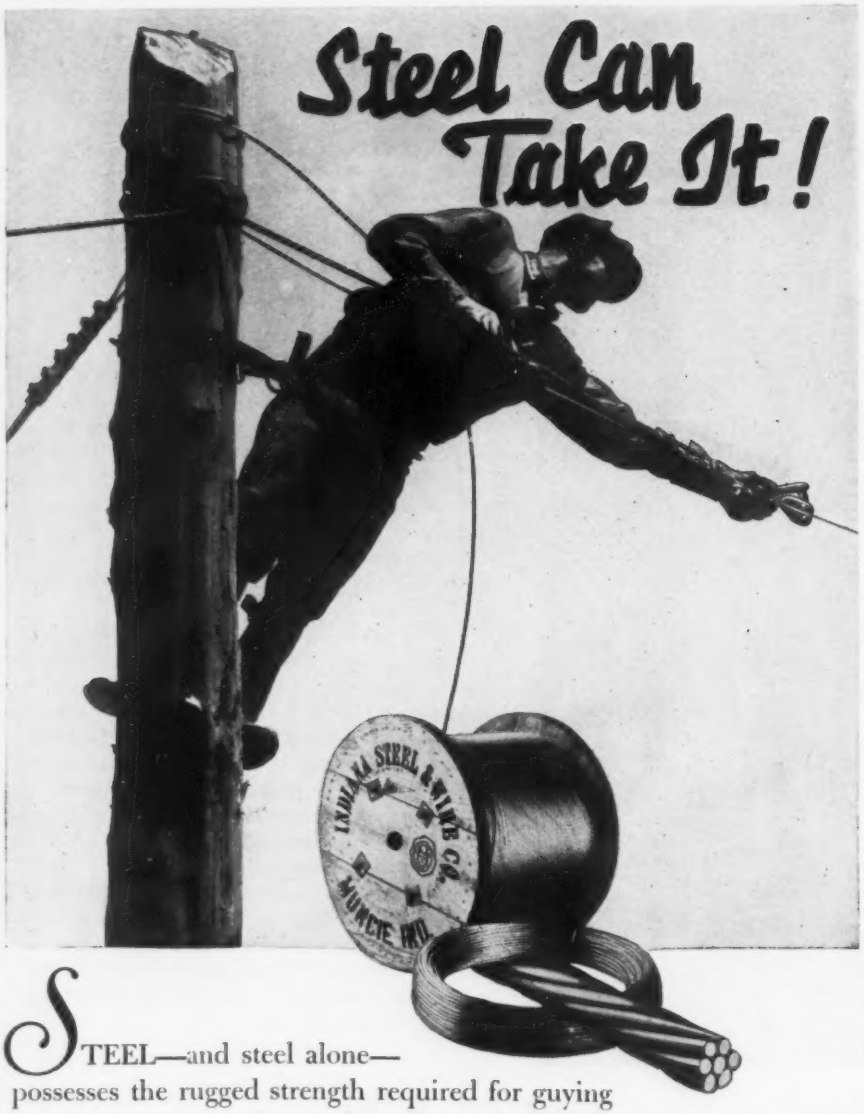


STEEL—and steel alone—possesses the rugged strength required for guying a pole structure . . . for steel can take the punishment encountered both in construction and in service.

All the strength and ruggedness inherent in steel is developed to the fullest extent in *Crapo* Galvanized Steel Strand. Each size and grade is manufactured from steel of selected analysis and processed from start to finish to do the job for which it is intended.

The heavy, ductile, tightly-bonded zinc coating—applied by the famous *Crapo* Galvanizing Process—provides lasting protection against corrosion; extends the life of the strand beyond the normal period of replacement.

There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you, or write for further information!

INDIANA STEEL & WIRE COMPANY . . . . . MUNCIE, INDIANA

Crapo GALVANIZED STEEL STRAND

PRODUCTS

that are news

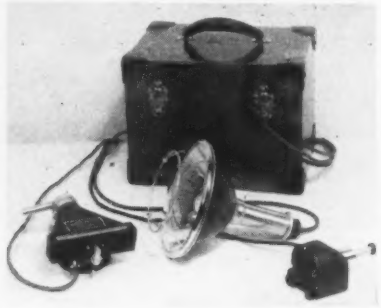
"Magic Grip" Sheave (300)

Allis-Chalmers is manufacturing a "Magic Grip" sheave, which it states was designed for faster, easier mounting. Each sheave comes completely assembled with bushing and is mounted by sliding to position and tightening three capscrews. The only installation tool needed, a wrench, is furnished with the sheave.

The individual bushing assembly consists of tapered split sleeve, collar and snap ring. It slides almost all the way into the tapered bore of the sheave without forcing. Slight clearance is left between bushing collar and sheave hub. Tightening of hollow-head capscrews draws bushing deeper into tapered bore, compressing the split sleeve and locking the entire sheave uniformly to the shaft, it is explained. Torque is transmitted through keys.

Dynamic Balancing (301)

Vibroscope Inc. announces that it has added a remote control feature on its portable equipment for dynamic balancing of machine parts. This balancing equipment includes a vibrometer which measures vibration amplitude directly and a stroboscope which gives



a direct visual reading of phase angle. The new remote control switch is mounted on the vibrometer and places the operation in the hands of a single operator. In earlier models, adjustments were made by a second operator.

Winch Control (302)

A unit type cargo winch control for open deck installations is being manufactured by General Electric Co. This unit was designed for use on Victory and other ships where the size of the deck houses in which the controls are located has been reduced to provide additional space for cargo. A feature, according to the manufacturer, is the standardized dimensions of the various units, facilitating interchange with similar units of other manufacturers.

Porthole Ventilator (303)

An electric porthole ventilator has been developed by Ilg Electric Ventilating Co. In one position, the fan pulls in outside air; by means of a supporting arm with hinge, the fan unit can be reversed (180°) to exhaust stale air, smoke and odors; with another adjustment of the supporting arm and hinge the unit swings back out of the porthole and locks into any desired position for use as a circulating fan.

Like automobile tires, mine locomotive wheels wear out. New wheels are hard to get, expensive, require critical steel.

"Retreading" ... WITH STEEL

By welding layers of steel to the worn wheel, then machining this "retread" to the standard tire contour, badly worn locomotive tires—and axles too—can be reclaimed.

Wartime steel shortages, and the pressing need to keep equipment running, has greatly increased the need for this maintenance service.

Westinghouse District *Manufacturing & Repair** Plants in the nation's coal mining areas have more than doubled their facilities for handling this vital emergency service.

Every Westinghouse M & R Plant is a part of a nationwide service organization—with local branches as close as your telephone. Factory trained men, using factory methods and equipment, are ready to give you complete, dependable repair service on any type of electrical equipment. J-90501

When vital electrical equipment needs repair . . . phone the nearest office of Westinghouse Electric and Manufacturing Company for

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

COMPLETE REPAIR SERVICE

*33 M & R PLANTS • • ONE NEAR YOU

SURE, that Saturday night pay envelope's bulging. But let me tell you something, brother, before you spend a dime . . . *That money's mine too!*

I can take it. The mess out here. And missing my wife and kid.

What I *can't* take is you making it tougher for me. Or my widow, if that's how it goes. And brother, it *will* make it tough—if you splurge one dime tonight. You're making money. More money than there's stuff to buy. Money that can sock the cost of living to kingdom come—if you blow it! So hang on, till the job's done. On to every last dime—till the squeal means a hole in the seat of your pants!

You're working . . . and *I'm fighting* . . . for the same thing. But *you* could lose it for both of us—without thinking. A guy like you could start bidding me right out of the picture tonight. And my wife and kid. There not being as much as everybody'd like to buy—and you having the green stuff. But remember this, brother—everything you buy helps to send prices kiting. Up. UP. AND UP. Till that fat pay envelope can't buy you a square meal.

Stop spending. For yourself. *Your* kids. And mine. That, brother, is sense. Not sacrifice.

Know what I'd do with that dough . . . if I'd the luck to have it?

I'd buy War Bonds—and, God, would *I* hang on to them! (Bonds buy guns—and give you four bucks for your three!) . . . I'd pay back that insurance loan from when Mollie had the baby . . . I'd pony up for taxes cheerfully (knowing they're the cheapest way to pay for this war) . . . I'd sock some in the savings bank, while I could . . . I'd lift a load off my mind with more life insurance.

And I wouldn't buy a shoelace till I'd looked myself square in the eye and knew I couldn't do without. (You get to knowin'—out here—what you can do without.)

I wouldn't try to profit from this war—and I wouldn't ask more for anything I had to sell—seeing we're all in this together.

I've got your future in my rifle hand, brother. But you've got both of ours, in the inside of that stuffed-up envelope. You and all the other guys that are lookin' at the Main Street shops tonight.

Squeeze that money, brother. It's got blood on it!

Use it up . . . wear it out, make it do...or do without

HELP US KEEP PRICES DOWN

A United States war message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by the Magazine Publishers of America

Choose GENERAL ELECTRIC RIGID CONDUIT

For Life Time Wiring Protection

G-E ELECTRICAL METALLIC TUBING

Use high quality G-E Electrical Metallic Tubing to protect wiring when rigid conduit is not required for utmost protection against mechanical injury or corrosive conditions. It is made of open hearth steel and is electro-galvanized on the outside and black enamelled on the inside. It bends easily and accurately. Compression fittings are available.

FOR FURTHER INFORMATION on G-E Rigid Conduit, Electrical Metallic Tubing, Wire and Cable or Wiring Devices, see the nearest G-E Merchandise Distributor or write to Section CDW343-18, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

Hear the General Electric radio programs: The G-E "All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

★ **BUY WAR BONDS** ★

Your customers will be pleased with the G-E Rigid Conduit installations you make for them. Two different G-E conduits are available. Both are leaders in their classes.

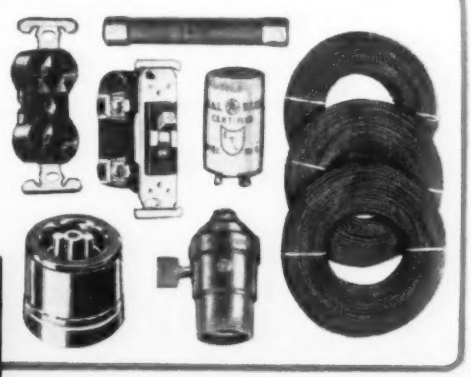
G-E White Rigid Conduit is hot-dipped galvanized and Glyptal-coated inside and out. This method of manufacture provides a heavier coating of zinc than could be applied in any other way.

G-E Black Rigid Conduit is coated inside and out with tough asphaltic-base enamel which remains chemically inert in the presence of corrosive liquids or fumes.

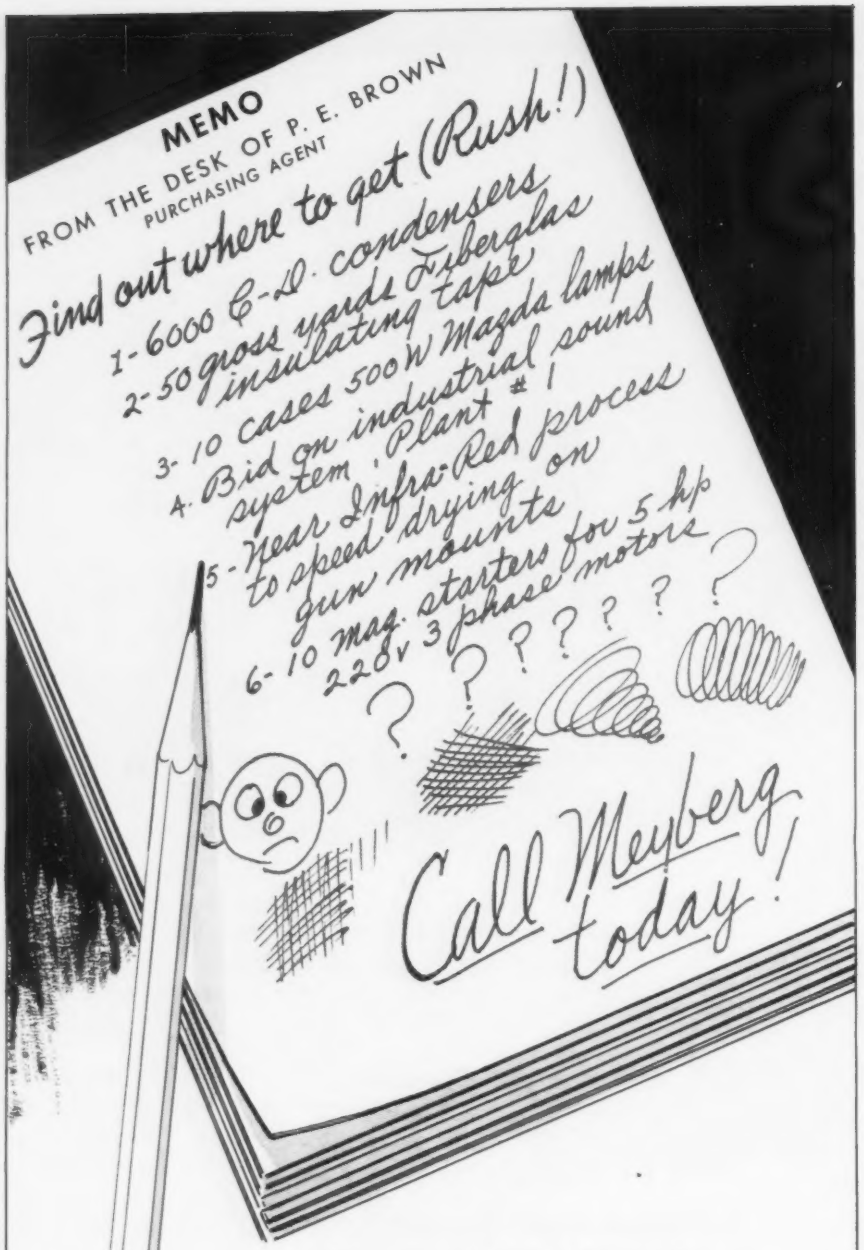
G-E conduits are made of mild steel tubing and are easy to bend. Threads are sharp and accurate. Proper boxes and fittings are available.

G-E WIRE AND CABLE AND WIRING DEVICES

There are G-E wires and cables and wiring devices for every purpose including Type SN small diameter building wire and hundreds of wiring devices—switches, lampholders, outlets, etc.



GENERAL ELECTRIC


MEMO
FROM THE DESK OF P. E. BROWN
PURCHASING AGENT
Find out where to get (Rush!)
1-6000 C-D. condensers
2-50 gross yards Fiberglas insulating tape
3-10 cases 500 W Mazda lamps
4-Bid on industrial sound system, Plant #1
5-Near Infra-Red process to speed drying on gun mounts
6-10 mag. starters for 5 hp 220v 3 phase motors
? ? ? ? ? ? ?
Call Meyberg today!

IF you are an industrial buyer with a merry-go-round of rush orders on your memo pad, you've got an easy out. We may be able to supply you at once out of our extensive stocks—most complete in the West. Meyberg supplies and services literally "cover the spectrum" with electric and electronic merchandise; Near Infra-Red industrial heating; industrial lighting installations and sound systems.

For quick delivery, "how to get it" information and industrial engineering service it will pay you to *call Meyberg first.*

LEO J. MEYBERG CO.

Incorporated

SAN FRANCISCO, 70 Tenth St., Zone 3 TELEPHONE UN 1212

LOS ANGELES, 2027 S. Figueroa St., Zone 7 TELEPHONE PR 6011

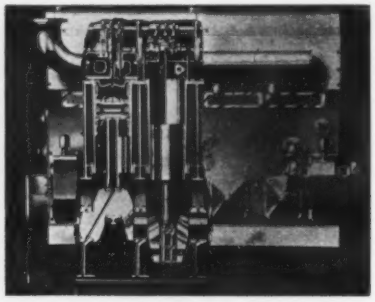
MOST COMPREHENSIVE INDUSTRIAL ELECTRIC AND ELECTRONIC STOCKS IN THE WEST

Diesel Engine (304)

Joshua Hendy Iron Works has announced its new Series 50 diesel engine, a four-cycle unit, with a bore of 12 in. and a 15-in. stroke and normally rated at 83.3-hp. per cylinder at 500 rpm.

Features of the engine are welded steel construction, overhead camshaft, dual intake and exhaust valves, oil-cooled pistons, precision type bearings, fully automatic lubrication and unit injectors.

Unit type fuel pumps and injectors combine with overhead camshaft to reduce the



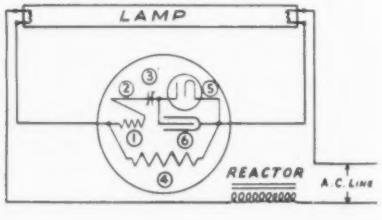
number of working parts, the announcement states. The valve and rocker-arm design insures valve seating without side thrust on the valve stems and reduces valve adjustments in service. Unit fuel injectors in each cylinder eliminate need for long, high-pressure fuel lines between the injection pump and the nozzle.

Marine models are fresh-water cooled, and either heat exchangers or keel condensers can be supplied. They are also direct reversing with all controls located at one central point, it is stated.

F Starter (305)

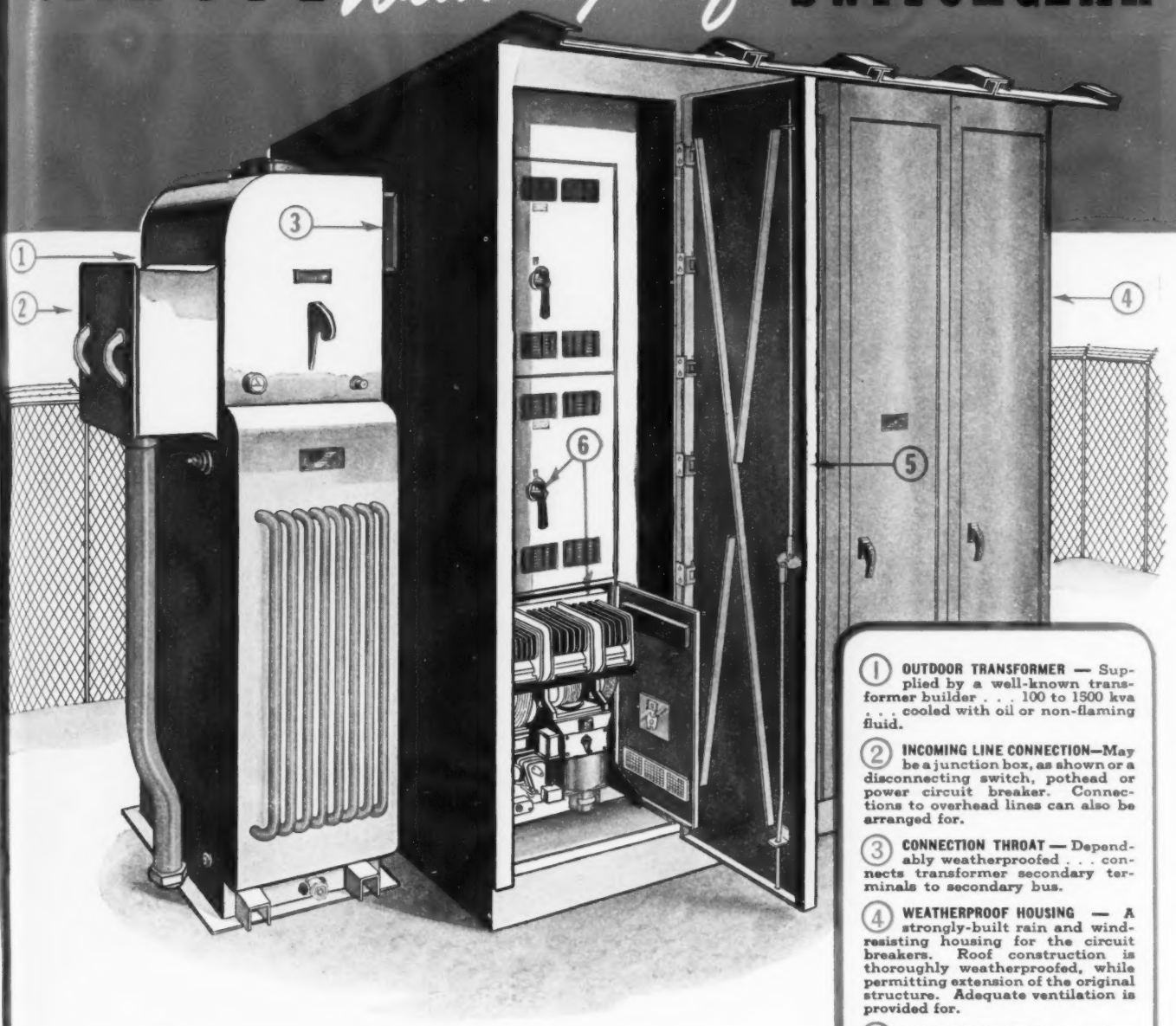
Westinghouse has designed an automatic fluorescent starter which eliminates blinking and reduces current flow through lamp auxiliaries to save power. The device utilizes a simple form of thermal switch in series with the timing switch. When the lamp is in good operating condition the starter functions normally; when the lamp fails, the starter makes a few attempts to put it in operation. The resultant heat brings the thermal switch into action and the lamp circuit is permanently opened. When the burned-out lamp is replaced, the starter automatically resumes its normal function.

The diagram shows the following: Low resistance heater (1) carries the starting cur-



rent, and as the glow switch attempts to start a deactivated lamp, gradually heats the bi-metal (2) and opens lock-out contacts (3) in the glow switch (5) circuit. Open-circuit voltage then exists across resistor (4) which draws a negligible current (power less than 1 watt), but produces sufficient heat to hold lockout contacts (3) open. When the failed lamp is replaced the starter automatically resets to its normal position ready to function again. Condenser (6) eliminates radio interference.

INVESTIGATE THE POSSIBLE SAVINGS WITH I-T-E *Weatherproof* SWITCHGEAR



(1) **OUTDOOR TRANSFORMER** — Supplied by a well-known transformer builder . . . 100 to 1500 kva . . . cooled with oil or non-flaming fluid.

(2) **INCOMING LINE CONNECTION**—May be a junction box, as shown or a disconnecting switch, pothead or power circuit breaker. Connections to overhead lines can also be arranged for.

(3) **CONNECTION THROAT** — Dependably weatherproofed . . . connects transformer secondary terminals to secondary bus.

(4) **WEATHERPROOF HOUSING** — A strongly-built rain and wind-resisting housing for the circuit breakers. Roof construction is thoroughly weatherproofed, while permitting extension of the original structure. Adequate ventilation is provided for.

(5) **FULL-LENGTH DOORS** — Three-point latches, stiffening braces, flanged edges and concealed adjustable hinges are furnished. Provision can be made for locking the doors when closed.

(6) **CIRCUIT BREAKERS** — Drawout type, manually or electrically operated . . . current and interrupting rating to suit your requirements. Each breaker is protected by a hinged door with ventilating louvers and may be operated manually without opening door. In capacities up to 1600 amperes, the circuit breakers are mounted three-high as shown. A wide range of protective devices is available to guard against overcurrent, short circuits, low voltage and other abnormal conditions.

No brick and mortar structure to build, since I-T-E Weatherproof Switchgear can safely be placed anywhere outdoors. By choosing a location close to the plant area where power is used, cables for low-voltage current can be short. These are savings. Add to them the provisions I-T-E makes for long service life under outdoor conditions—tightness of welded-steel structures, the protection qualities of I-T-E finish, the durable circuit breakers capable of performing with minimum of maintenance. Let I-T-E engineers give you the cost figures of outdoor substations in accordance with your specifications.

Representatives in Principal Cities

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

The Army-Navy "E" for Production Excellence

I-T-E

CIRCUIT BREAKER CO., PHILADELPHIA 30, PA

GENERAL ELECTRIC

TO move the sun indoors . . . to bring into our homes, stores, schools, offices, and factories the kind of lighting that compares favorably with daylight . . . that has been the constant vision of General Electric lamp research scientists.

Today the goal is closer than ever before . . . perhaps closer than many of us realize. And yet, we have only just begun to explore the possibilities of new lighting techniques.

BUY AN EXTRA WAR BOND NOW!

Some of these lighting tools will be available as soon as the requirements of war production have been met; some must await the development of manufacturing facilities; others require further study in research laboratories.

The introduction of fluorescent lighting by General Electric opened the door to a new world of better lighting. Continued G-E research will open the door much wider.

Hear the General Electric radio programs: "The G-E All-Girl Orchestra" Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

GENERAL ELECTRIC

FLUORESCENT RESEARCH LOOKS AHEAD

THESE NEW ADDITIONS ALREADY ARE PLANNED FOR G-E's POST-WAR FLUORESCENT LAMP LINE

TO make a complete line of lamps and the best lamp for every lighting need always has been the aim of General Electric lamp research.

Numerous requests indicate that the lighting industry wants to know about new lamp developments as far in advance as possible. Looking toward the future, G-E sees the need for several new fluorescent lamps.

As soon as conditions permit, we expect to extend our line of G-E Mazda fluorescent lamps by offering the following new lamps:

STRAIGHT TUBULAR G-E MAZDA F LAMPS

LENGTH (INCLUDING SOCKETS)	APPROXIMATE BULB DIAMETER
Approximately 5½ ft.	T-4 or T-5
" 5½ ft.	T-6
" 5½ ft.	T-8
" 7½ —8 ft.	T-6

CIRCULAR G-E MAZDA F LAMPS

(Announced December 27, 1943)

APPROXIMATE OUTSIDE DIAMETER	MAXIMUM BULB DIAMETER	APPROXIMATE WATTS
8½"	T-10	20
12¼"	T-10	30
16 "	T-10 or T-12	40

G-E Lamp Research has been, and still is, at war. Because of wartime restrictions, no production facilities for these lamps are at present available, and therefore *no samples can be furnished.* However, as soon as it is possible to estimate when such lamps can be manufactured, we will give you further details and additional information as to transformers, ballasts, sockets, and other accessories.

* * *

No part of your business offers a better opportunity for *immediate* post-war profits than G-E Mazda lamps. The demand for better lighting will be tremendous. General Electric will be ready to supply the lamps and help you sell them.

"TO MAKE LAMPS STAY BRIGHTER LONGER"
The Creed of G-E RESEARCH

G-E MAZDA LAMPS

Electric Cables by Simplex

for Power, Communication and Control

With "synthetic rubber" insulation

which, during the past two years has gradually taken the place of natural rubber compounds. Performance records already promise an important future for Simplex "synthetic rubber" insulation for power, communication and control cables.

Subject to W.P.B. regulations

With varnished cambric insulation

for high voltage over short distances. Particularly suited for station or power house wiring and where operating temperature is high. Varnished cambric insulated cables may be covered with weatherproof or flameproof braids, lead sheath or steel armor.

With impregnated paper insulation

for transmission of large blocks of power at higher voltages. Paper insulated cables are lead sheathed to keep moisture out. Best results can be obtained when cables are specially designed for the work they are to do.

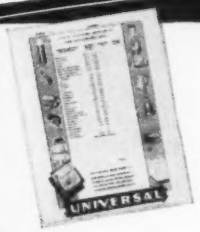
If your postwar plans call for new cables — submarine, underground or aerial — for repairs, replacements or expansion, we shall be pleased to tell you what we can do for you now to help you prepare for the change from war work to "business as usual." It will be greatly to your advantage if you act quickly when the time comes.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex

WIRES and CABLES

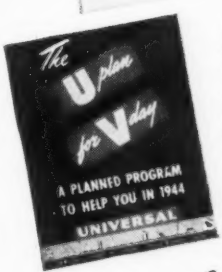
PACIFIC COAST OFFICES
200 Fourth St. 910 East Third St. 503 Polson Bldg.



"U" PLAN CHECK LIST – Quantities of "U" Plan Check Lists are being supplied to "U" Planners free of charge. They can be used as an economical mailing piece with your own letter on the back and can then serve as a basic part of your priority or preference system.

NATIONAL ADVERTISING—Every "U" Planner reaps the benefit of full page color advertisements running in 14 national magazines throughout the year. Forty million messages featuring the "U" Plan will be addressed to present and post-war customers. To take advantage of this advertising campaign now in full swing, you must identify your store as "U" Plan Headquarters.

PROMOTIONAL PACKAGE – The free Promotional Package includes blow-ups of National Advertising, Counter Cards, Window Cards and Window Banners that tell customers at a glance you are a "U" Planner. Consumer Booklets, War Bond Envelopes and Check Lists help you make direct contacts and a complete Mat Service makes it possible for you to announce the "U" Plan in local newspapers.



PLAN BOOK—The "U" Plan for "V" Day takes concrete form in the 20-page four-color Plan Book which explains every phase of the activity in detail. The Plan Book alone is a contribution to intelligent, down-to-earth post-war planning. Send for it today as your first step toward becoming a "U" Planner.

Ask yourself—can I afford to miss tying in with the "U" Plan for "V" Day. Universal is contributing the Plan, the National Advertising, Plan Book and Promotional Package. You invest no money—merely fill out the coupon to get started. Do it now!

YOURS FOR THE ASKING!

UNIVERSAL

LANDERS, FRARY & CLARK • NEW BRITAIN, CONN.

LANDERS, FRARY & CLARK Dept. EW
New Britain, Conn.

Gentlemen:

I wish to become a "U" Plan Dealer – please send free "U" Plan for "V" Day Plan Book to

*Name*_____

*Address*_____

*City*_____ *State*_____

"THIS YEAR, LET'S PAY THE BONUS IN WAR BONDS

. . . and drive even harder on the pay-roll savings plan!"

Make War Bonds the Christmas Order of the Day. Urge your workers to make their personal Christmas gifts in the form of War Bonds—and practice what you preach! Make this a 100% War Bond Christmas—to insure future Yuletides of peace and prosperity.

Make up your own posters to spread the "War Bonds for Christmas" story across your plant. Tell the story again and again on bulletin boards, in your plant magazine, and on pay envelope stuffers.

But don't forget your basic, all-important Pay-Roll Savings Plan. How's it going, these days? Perhaps it needs a bit of stoking-up right this very minute, to hold its full head of steam against the competitive demands of the holiday season.

Well, you're the man to stoke it! You can't expect it to keep running indefinitely on last summer's enthusiasm. See to it that your participation percentages, and your deduction percentages, *both* end up the year at new levels.

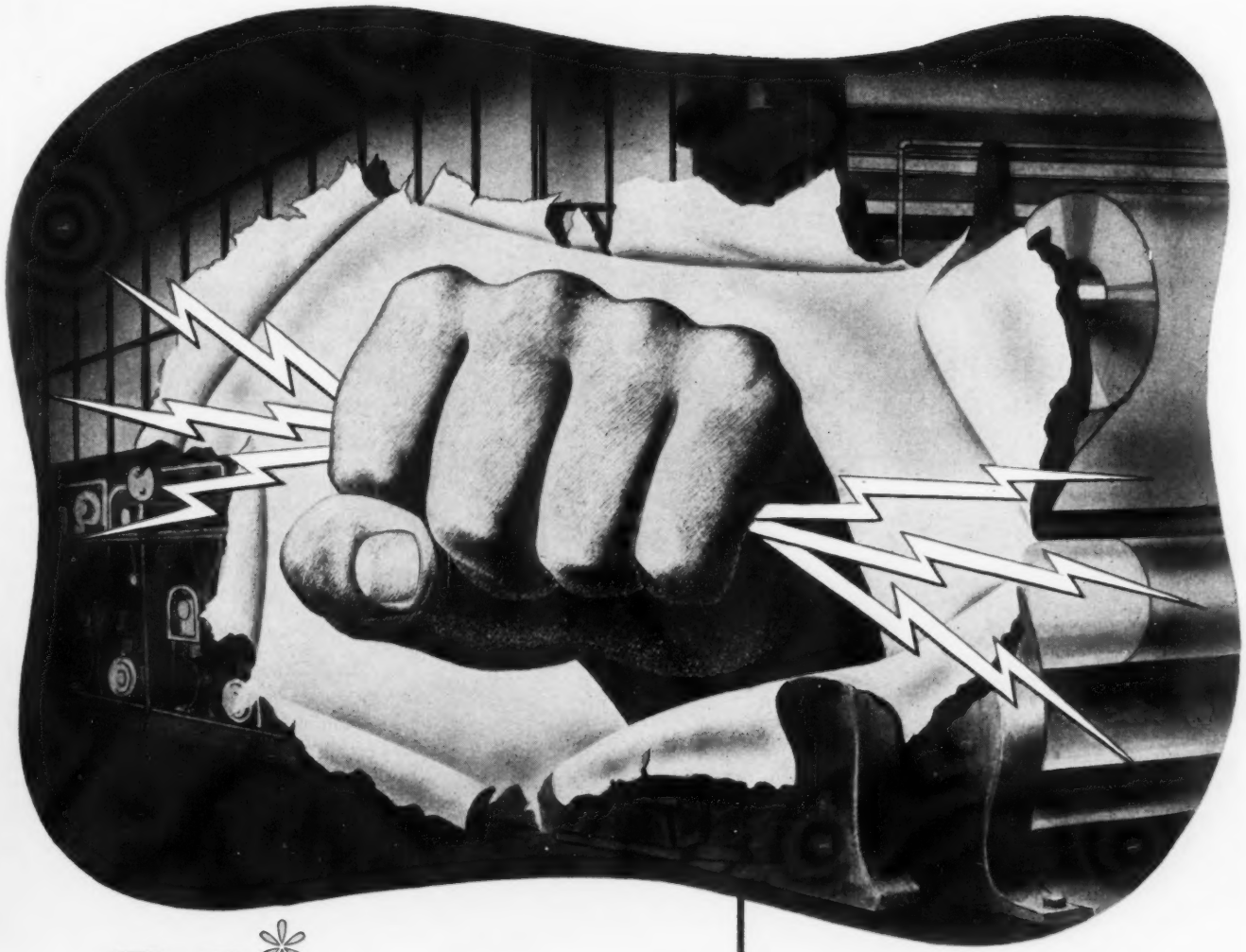
Every month, now your Pay-Roll Savings ought to run well ahead of the preceding month. *For so many families that formerly depended on the earnings of a single worker, now enjoy the combined earnings of several.* Such *family* incomes are doubled, trebled, even multiplied many times.

Now's the time to turn as much as possible of these increased earnings into War Bonds—War Bonds for Christmas . . . and War Bonds the whole year 'round!

GIVE THE PRESENT WITH A FUTURE—WAR BONDS!

This space contributed to Victory by **ELECTRICAL WEST**

This advertisement prepared under the auspices of the United States Treasury Department and the War Advertising Council



O.S.* HOLDS POWER AT ITS PEAK IN PAPER-MILL TURBINE

There's no lag in power at the Monroe Paper Products Company. The superior oxidation stability of Shell Turbo Oil sees to that. In fact, a sample drawn from this hard working turbine after 25,920 hours of continuous operation showed the ability of Shell Turbo Oil to *resist oxidation* to an unusual degree. It was as clear as the day it was put into the system! In addition to its exceptional *oxidation stability*, Shell Turbo Oil also provides *protection against rust!*

Draw a sample of oil from your turbines. Compare it with the analyses of Shell Turbo Oil at right. Can the oil you now use match this performance?

For details on this and other outstanding performances of Shell Turbo Oil see the Shell man. Or, write Shell Oil Company, Inc., Dept. "H", 50 W. 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, California.

CERTIFIED PROOF OF THE SUPERIOR

*OXIDATION STABILITY

OF SHELL TURBO OIL

150-170	CHARACTERISTICS Viscosity @ 100° F.	168
Clear	Appearance	Clear
.05	Neutralization No.	.05
.1	Saponification No.	.2

Performance record of Shell Turbo Oil in a unit of the Monroe Paper Products Co., Monroe, Mich.

SHELL TURBO OIL

Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil

SHELL

LLOYD STARTERS

Like Any Champion

•••Perfect in Starting

•••Smooth in Performance

•••Great in Endurance

Lloyd Starters Are Listed and Approved by Underwriters' Lab. Inc., and Canadian Eng. Stand. Assn.

Certified by Elec. Testing Lab., Spec. 6

Certified to Fleur-O-Lier Standards

Lloyd Policy Insures Quality

LLOYD PRODUCTS CO.

PROVIDENCE 5, R. I.

Representatives, Branch Offices and Warehouse Stocks in 23 Leading Cities

Export Address: 13 E. 40th St., New York 16, N. Y.

Searchlight (306)

General Electric has announced a new high-intensity searchlight available in 12-, 18- and 24-in. diameters and in a variety of mountings suitable for shipboard and land use. According to the manufacturer, the smallest-sized unit provides four times the candlepower of an incandescent lamp the same size. Light source is a midget capillary type 900-watt mercury lamp, which throws a flat, concentrated beam capable of illuminating distant horizontal surfaces from a low mounting height.

The lamp is air-cooled. When the searchlight is on, air is forced constantly through a rubber hose into the top of the searchlight drum by an air compressor. This air compressor, which is optional, provides oil- and moisture-free air at 25 lb. per square inch pressure at a rate of 6 cu. ft. per minute. It is driven by a ¾-hp. motor.

Measured candlepower values range from 7,500,000 for the 12-in. to 32,000,000 for the 24-in. unit. Mountings are of the pilot house control, low-base, stanchion or high-pedestal type. The pilot house control allows vertical movement 45° above and below horizontal and 335° rotation; other mountings allow 45° depression and elevation straight up vertically and 360° rotation.

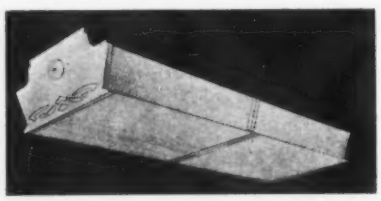
Bushing Cement (307)

John C. Dolph Co. is publicizing its No. 16-A bushing cement. Developed several years ago to cement transformer leads into porcelain bushings, during the war it has been adapted for use as a permanent sealer for cable joints, boxes, instruments and similar applications.

This cement is a black compound said to have excellent adhesiox to metal and porcelain and a very low coefficient of contraction. According to the announcement, it becomes extremely hard and will stand the strain of rapid temperature changes. It is both oil and waterproof. Melting point is 265° F and pouring temperature is 400° F.

Commercial F Unit (308)

A new commercial fluorescent fixture for four 40-watt lamps is being manufactured by the Spero Electric Corp. This unit has translucent diffusing glass panels at side and bottom to shield the light source. Intensity, according to the manufacturers, is 16 f-c per

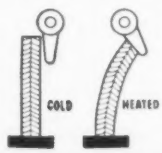


watt per square foot. Conforming to latest WPB requirements, the unit is available for flush-to-ceiling, pendant or continuous-row mounting. Glass panels are said to be easily removed for cleaning and servicing lamps.

Truck Controller (309)

Elwell-Parker Electric Co. has introduced a simplified four-speed reversing controller for its electric and gas-electric trucks. The controller features power saving by using resistance on the first speed only and by manipulation of the motor fields, connecting them in series on first and second speeds to produce greater torque with less current consumption.

Wild arcs tamed *Quick!*



CALLING THE TRICK is the job of this Westinghouse Bi-metal Element. Two metals which react differently to heat are bonded together. Threatening overloads cause the Bi-metal to bend, tripping the interrupting mechanism and opening the circuit—*before* any damage is done.

TAMING THE ARC is the job of the "De-ion" arc quencher. It consists of parallel metal plates in the form of a grid. The arc is drawn into the quenching chamber . . . divided into segments . . . smothered between the plates—in the space of a half cycle.

When current's on the rampage, a circuit breaker has to function *fast* and *sure*—every time!

Westinghouse "De-ion" Circuit Breakers are built for just such hair-trigger protective action. They pass harmless overloads without interruption, but let danger threaten, and quicker than a blink of the eye—the circuit's opened . . . the arc is quenched. Burns and pits are minimized; contacts stay cleaner, last longer.

Once the disturbance is cleared, service is instantly restored by a flip of the indicating handle. No waiting—no repairs—no parts to replace.

Protect equipment and circuits with Westinghouse "De-ion" Circuit Breakers. Ratings up to 600 amperes; enclosures for nearly every type of service. Call your Westinghouse Representative today. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

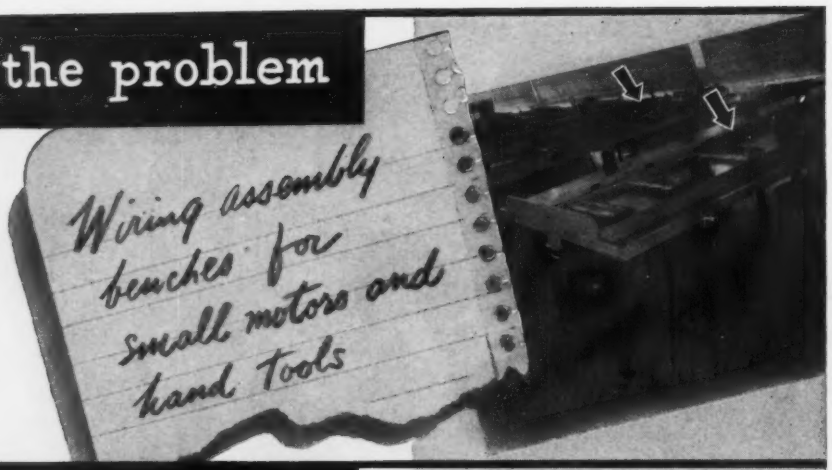
J-21298

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

"DE-ION" CIRCUIT BREAKERS

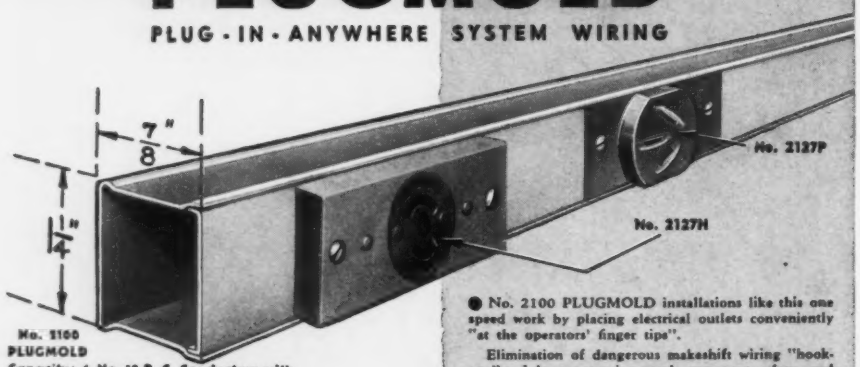
the problem



the answer

PLUGMOLD

PLUG-IN-ANYWHERE SYSTEM WIRING



No. 2100 PLUGMOLD
Capacity: 6 No. 12 R. C. Conductors with receptacles installed; 10 No. 12 R. C. Conductors without receptacles.

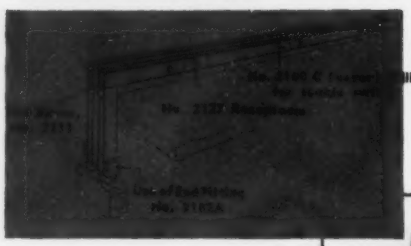
● No. 2100 PLUGMOLD installations like this one speed work by placing electrical outlets conveniently "at the operators' finger tips".

Elimination of dangerous makeshift wiring "hook-ups" and long extension cords promotes safety, and removes a source of constant maintenance expense.

With PLUGMOLD, outlets can be located exactly where needed and in the number and types required for a specific application. Individual or group switch control may be arranged as shown.

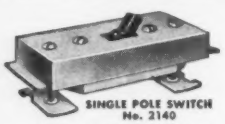
No. 2100 PLUGMOLD Channel and Fittings are listed by Underwriters' Laboratories, Inc., and conform to Federal Specification W-R-32.

Available for immediate delivery on suitable priorities. Write for new Industrial Wiring Bulletin describing this and other Wiremold wiring systems.

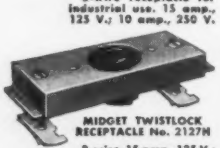


WIREMOLD CAN HELP YOU PRODUCE FOR WAR . . . WHILE YOU PLAN FOR PEACE!

POLARIZED RECEPTACLE
No. 2127P
3-wire receptacle for industrial use. 15 amp., 125 V.; 10 amp., 250 V.



SINGLE POLE SWITCH
No. 2140
May be installed at any desired point to control individual outlets. 10 amp., 125 V.; 5 amp., 250 V.



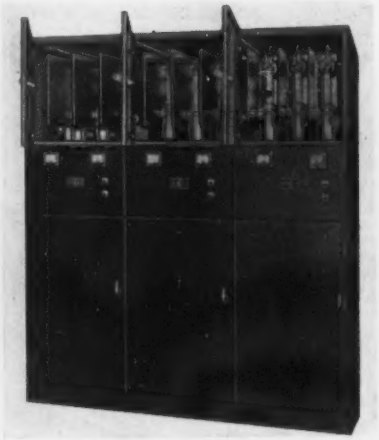
MIDGET TWISTLOCK RECEPTACLE No. 2127H
2-wire, 15 amp., 125 V.; 10 amp., 250 V. with integral cover section.

T-SLOT RECEPTACLE
No. 2127S
To accommodate plugs with either tandem or parallel blades. 15 amp., 125 V.; 10 amp., 250 V.

KNOW YOUR
WIREMOLD
AND YOU KNOW THE ANSWERS

THE WIREMOLD COMPANY HARTFORD 10, CONN

Control (310)



Electric Machinery Mfg. Co. has a control for synchronous and induction motors which it states uses split-cycle-operating, high-interrupting capacity power fuses to give dependable starting service with short-circuit protection.

These controls are available in live- or dead-front as well as metal-enclosed types.

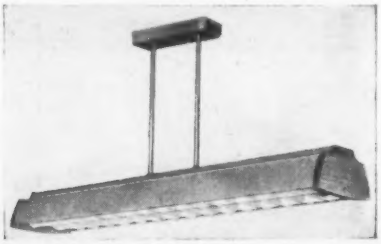
Calculator (311)

Emeloid Co. is offering a calculator for solving radio transmission line problems. This device is said to be a special kind of impedance coordinate system mechanically arranged with respect to a set of movable scales to portray the relationship of impedance at any point along a uniform open wire or coaxial transmission line to the impedance at any other point, as well as to the several other electrical parameters. Parameters plotted on the calculator include: Impedance and reflection coefficient at any point along the line; length of line between any two points in wave lengths; attenuation between any two points in decimals; voltage or current standing wave ratio.

Fluorescent Line (312)

A new line of commercial fluorescent units for office and drafting rooms has been announced by F. W. Wakefield Brass Co. The units are available on priorities of A1 or higher.

The Grenadier, shown in the illustration, is available either for ceiling or suspension mounting and is equipped with etched ribbed glass to reduce lamp brightness. Wooden



louvers are said to permit a high component of downward light and to prevent glare.

Other units in the line are the Captain for general illumination where seeing requirements are not severe; the Beacon, a glass paneled unit in which lamp brightness is reduced by frosted rib glass; the Admiral, a unit made largely of wood and providing a large component of downward light.

LINE OPERATORS DIDN'T NEED A WAR TO TEACH THEM THIS LESSON—

Don't be shortsighted about conductor size

ALUMINUM CABLE STEEL REINFORCED

A.C.S.R. size, A.W.G.	Copper equivalent, A.W.G.	Diameter, inches	Resistance, ohms per mile (61% at 25°C.)	Ultimate strength, pounds	Weight Pounds per 1000 feet
1/0	2	0.398	0.885	4280	145.6
2	4	0.325	1.41	3525	107.2
4	6	0.257	2.24	2288	67.4
6	8	0.198	3.56	1170	36.2

Even before the war, experienced operators had realized the wisdom of building lines with adequate conductors. Some were obliged to install voltage boosters to take care of expanding demands. Others were taking down and replacing conductors which had proved too small to deliver the power.

Designers of electrical lines can profit by this lesson so many others have learned. Your lines must not place a barrier in the way of such expansion. Revenue is dependent upon their ability to deliver power when and where it is needed.

Your promotion department is doubtless all set to teach farmers and homemakers how to make their work lighter by using more electricity. Manufacturers of electrical appliances will certainly do likewise, just as soon as they can resume production. Plan on plenty of conductivity to take care of these growing loads.

Alcoa engineers will gladly assist you in the selection of the proper size of A.C.S.R. Write to Aluminum Company of America, 2132 Gulf Building, Pittsburgh, Pennsylvania.

ARMOR RODS...
AN ALCOA CONTRIBUTION TO GREATER RELIABILITY

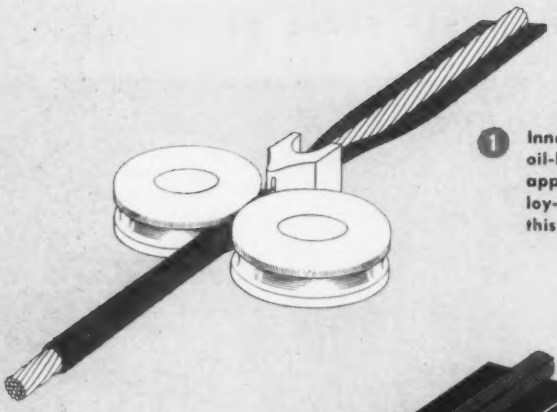
REINFORCEMENT AT SUPPORTS

ALCOA A·C·S·R

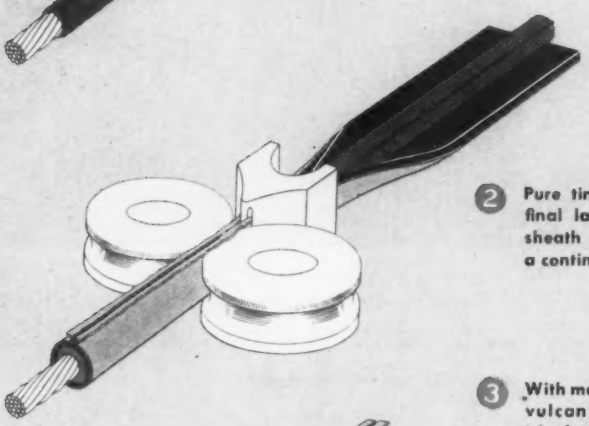
ALUMINUM CABLE STEEL REINFORCED

OKOLITE-

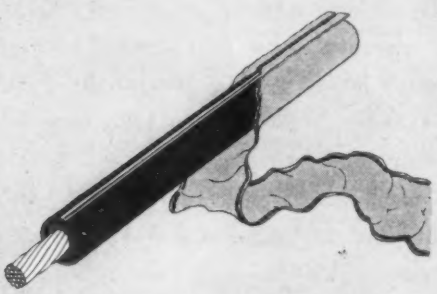
HAS A HIGHLY-DESIRABLE COMBINATIO



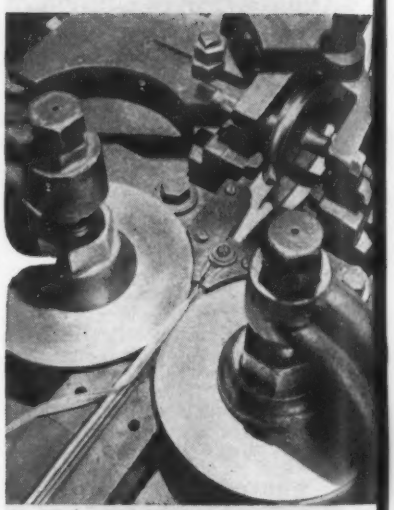
1 Inner strips of Okolite oil-base insulation are applied about the Okoloy-coated conductor in this manner.



2 Pure tin backing on the final layer of Okoprene sheath compound forms a continuous metal mold.



3 With metal removed after vulcanization, the finished Okolite-Okoprene wire is ready for testing and shipment.



3 ESSENTIAL STEPS IN THE OKONITE STRIP-INSULATING PROCESS

* Insulated with Okolite oil-base insulation and protected by a sheath of Okoprene, made with neoprene, Okolite-Okoprene cables may be installed in ducts, buried directly in the earth or exposed to the elements *without additional protection.*

OKOPRENE*

OF IMPORTANT PROPERTIES . . .

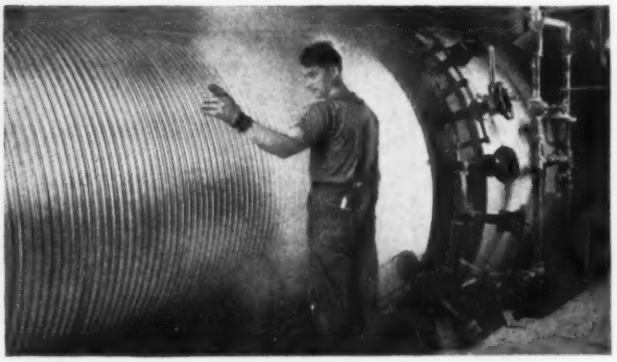
The accompanying table shows the many advantages of using Okolite-Okoprene wires. But these neoprene-sheathed wires have *all* these characteristics only because they are made by the strip-insulating process which starts by coating the conductor with Okoloy and ends by vulcanizing the insulated wire under pressure in a continuous metal mold. This Okonite method illustrated here, provides:

BETTER CONDUCTOR PROTECTION: All Okolite-Okoprene conductors are protected against corrosion by a coating of Okoloy, an *alloy that outlasts tin at least 2 to 1* (Bulletin OK-2019).

CONDUCTOR PROPERLY CENTERED IN INSULATION: The Okonite strip-process of insulating the conductor ensures a uniform wall of Okolite because it is applied in layers of *predetermined* thickness (Bulletin OK-1014).

UNIFORM SHEATH THICKNESS: Since the final layer of protecting Okoprene sheath is also applied by the strip-process, it, too, is of *predetermined* thickness.

SINGLE, HOMOGENEOUS ASSEMBLY: Both *insulation and sheath are securely bonded* together when vulcanized under pressure in the continuous metal mold. This results in greater density and uniformity and, hence, longer life.



Removing the drum of insulated conductor after vulcanization under pressure in its continuous metal mold.

PROVED IN SERVICE: Okolite-Okoprene wires, made by this 60-year old process, have been proved in service under every conceivable type of installation — on railroads, in power and light companies, mines, industrial plants, refineries and buildings.

Okolite-Okoprene wires and cables are available in all standard sizes and many colors for service up to 5000 volts. For further details, send for Bulletins OK-2007A, OK-2009C and OK-1008 . . . The Okonite Company, Passaic, New Jersey. *Pacific Coast Offices, 2441 Hunter St., Los Angeles, 21, California . . . 1664 Russ Bldg., San Francisco, 4, California . . . 801 Northern Life Tower, Seattle, 1, Washington.*

ELECTRICAL, PHYSICAL AND INSTALLATION ADVANTAGES FORM A WELL-BALANCED COMBINATION IN OKOLITE-OKOPRENE WIRES

CONDUCTOR:
- Protected with Okoloy coating
- Resists corrosion
- Outlasts tinning 2 to 1

INSULATION:
- Okolite oil-base insulation
- Moisture-resisting
- Uniform thickness throughout length
- High, stable electrical values
- Meets W.P.B. wartime requirements

COVERING:
- Okoprene sheath made with neoprene
- Bonded securely to insulation
- No braids to rot
- *Resists:* sunlight, weather, flame, oil, chemicals and ozone
- Eliminates surface discharge and end leakage
- Provides smooth, tough covering

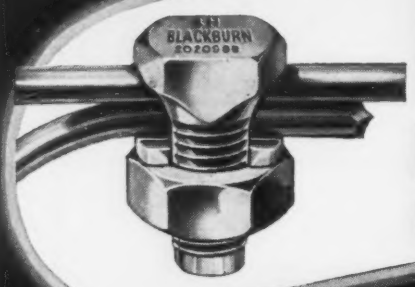
Okolite-Okoprene wires and cables are simple to handle, splice and terminate. If you are not already using them, it will pay you to know more about this modern, approved type of electrical cable.

Look for the single ridge on Okolite - Okoprene

OKONITE

INSULATED WIRES AND CABLES

TREMENDOUS TRIFLES /



BLACKBURN CONNECTORS

Yes, Blackburn Connectors are tiny gadgets, but millions of them are in important daily use by the electrical and telephone industries, throughout the world.

Blackburn Connectors are made completely of high-strength copper alloy, actually stronger than steel. All corners rounded . . . will not nick wires. Machined to close tolerances. Full threads on screw.

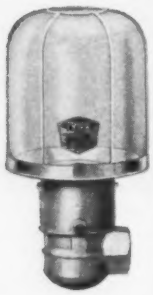
for DEPENDABILITY and ECONOMY, specify BLACKBURN CONNECTORS

Builders of Quality Connectors for Over 10 Years

JASPER BLACKBURN PRODUCTS CORP.
Main and Clinton Sts., St. Louis 6, Mo.
Over 75 Conveniently-Located Jobbers' Stocks

PROTECTION *against* UNNECESSARY SHUTDOWNS

TRICO OILERS
SAVE TIME - OIL - WORRY



Needless shutdowns, idle machinery, bearing failures, unnecessary repairs, waste, etc., are eliminated when you install TRICO visible automatic OILERS. You get many years of trouble-free service, with definite savings in operation and maintenance costs.

WRITE FOR CATALOG

TRICO KLIPLOK CLAMPS

That jack-screw pressure literally bolts fuses and clips together eliminating

- Premature fuse blowings
- Unnecessary shutdowns
- Night and holiday repairs
- Burnt fuses and clips
- Arcing at contacts
- Wasted current

Ten sizes to fit popular types of fuse clips. Write for Bulletin No. 6.

COAST REPRESENTATIVES
H. H. Van Luven, Los Angeles — Wallace R. Lynn Co., San Francisco
Albert S. Knight, Seattle — W. E. Young Co., Denver

TRICO FUSE MFG. CO. Milwaukee, Wis.

Compensator (313)

General Electric has a new current-regulating compensator for resistance welding machines. This control was designed to facilitate consistent welds by holding the rms. of the weld current constant for any heat-control setting, without requiring continual manual adjustment. It is said to hold the welding current to a variation of plus or minus 2% under conditions which would cause unregulated welding current to vary plus or minus 20%.

The compensator consists of an electronic control circuit which automatically retards or advances the firing point of the Ignitron tubes used to control the welding current, thus holding the current constant regardless of line voltage changes or welding conditions.

Welding Control (314)

General Electric has designed a thyratron welding control which it states provides precise control of low-capacity spot welders. In combination with the proper transformer, this unit may be used with either welding tongs or a small bench welder, and is recommended by the manufacturer for spot welding of vacuum tubes; welding solid or stranded wires to terminals of copper, brass, bronze, steel or ferrous alloys; joining two tinned-copper, steel or alloy wires; and spot welding thin pieces of various alloys. It may be operated on either 230 or 460-volt, 60-cycle power supply.

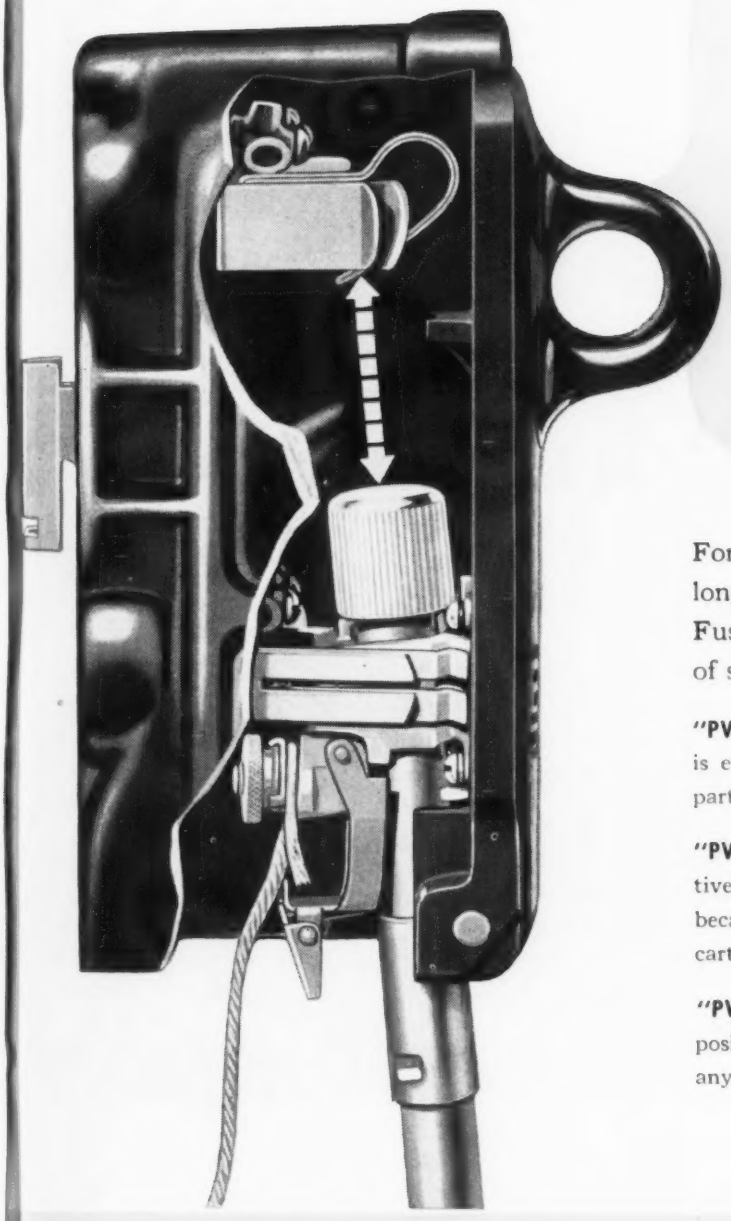
Motor (315)

A 60,000-rpm. motor has been designed by Westinghouse Electric & Mfg. Co. for grinding, polishing and routing metals in machine tool work. The new motor is of the induction type and is supplied with power from a 1,000-cycle generator. It is 1¾ in. in diameter and 2 in. long. Centrifugal stresses at the surface reach about 15,000 lb. per sq. in.

Mazda Line (316)

It has been announced that, when manufacturing conditions permit, the following will be added to the line of Mazda F lamps:

Length (approx.) Including Sockets	Bulb Diameter (Approx.)
5½ ft.	T-4 or T-5
5½ ft.	T-6
5½ ft.	T-8
7½-8 ft.	T-6



Check These THREE Big Advantages of L-M "PVD" Fuse Cutouts

For more complete protection of your lines, long life, and quick, easy re-fusing, L-M "PVD" Fuse Cutouts have proven themselves in years of satisfactory operation.

"PVD" KEEPS THE DOOR CLOSED: Operation of the cutout is entirely independent of door movement and working parts are protected at all times.

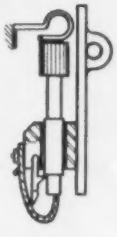
"PVD" TAKES CARTRIDGE OUT OF THE CIRCUIT: Arc is positively extinguished before any contacts move or separate because flip-out device pulls the link apart and out of the cartridge tube.

"PVD" PROVIDES PLAINLY VISIBLE INDICATOR: Tell-tale position of dropped down cartridge is readily visible from any direction and from a distance.

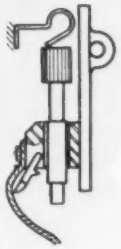
For full information write to:
Line Material Company, Milwaukee, Wis.

Here is cycle of operation of "PVD" Fuse Cutouts

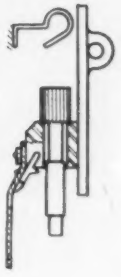
This view shows L-M "PVD" Fuse Cutout before fuse is blown.



When the fuse blows, the link flip-out device assures instant separation of the blown fuse link parts before the latching lever releases the tube to indicating position . . . a positive time delay.



Latching lever releases tube, upper contact follows tube assuring clearing of arc before contacts separate.



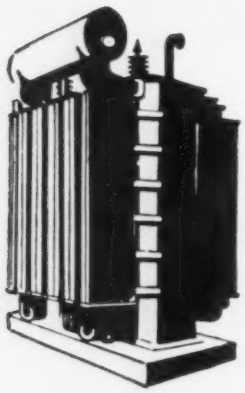
Dropped out position of cartridge acts as visual indicator. Wide air gap between contacts prevents arcing.

L-M DISTRIBUTION EQUIPMENT INCLUDES:

Transformers · Fuse Cutouts · Lightning Arresters · Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

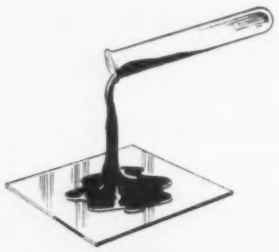
LINE MATERIAL COMPANY

FUSE CUTOUTS



An oil that doesn't lubricate

As any electrician knows, transformer oils are not intended to lubricate. They serve as an insulating medium and coolant.



Nevertheless, transformer oil must be exceptionally high quality. The oil must be free from water or any foreign substances to prevent arcing and shorting. It should have a low viscosity for rapid transfer of heat or the transformer will burn out and catch fire. Important, too, is the stability of the oil—high temperatures cause some oils to break down and form sludge. This sludge slows the circulation of the oil and impedes cooling. If this process continues, sludge residues can plug up lines and stop circulation.

Recognizing these needs, Union Oil developed Red Line Transformer Oil—a product that is the culmination of over 25 years experience in marketing transformer oils.

Red Line Transformer Oil is as pure as modern refining methods can make it. Specially packed, its dielectric strength is guaranteed at 27,500+ volts, showing a complete freedom from contamination by dust, lint, water or other foreign substances. Viscosity of this oil tests

at 50-60 seconds Saybolt Universal at 100° F. A Snyder Life Test that exceeds 40 days indicates remarkable oxidation stability, providing maximum speed of circulation and resultant cooling.

Red Line Transformer Oil is a laboratory-developed, field-tested product which fully meets modern, heavy-duty transformer requirements. You can get a supply by phoning your Union Oil Resident Manager.

The superior quality of this oil is typical of the efforts made by Union Oil to understand and furnish the petroleum needs of industry with highly-developed, scientifically-accurate products.

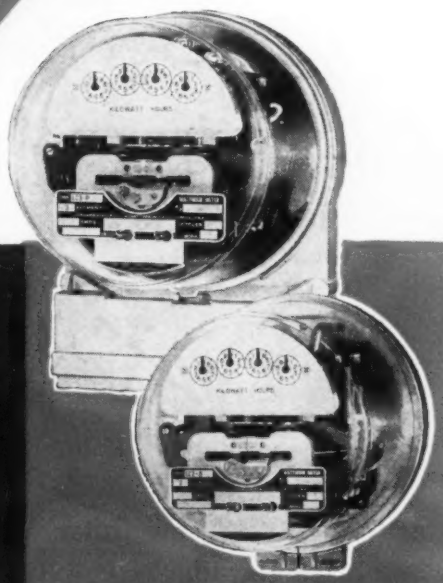
RED LINE TRANSFORMER OIL

WAR BONDS MAKE UNCLE SAM MORE POWER-*full*

ARMY E NAVY

"On Measurement is founded the whole progress of man.."

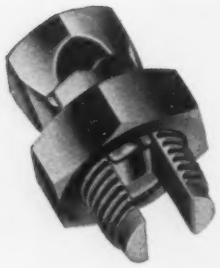
Even Father Time himself must have been intrigued by this intricate 422 B.C. gadget to measure the span of his passing years. "What is it?" he may have asked, and the explanation undoubtedly was "Why, it's a clepsydra!" This device, operated by water flowing regularly through a golden gate, filled a large vessel. The water level was indexed by simply dividing the time from sunrise to sunset by twelve, with the floating maidenly figure pointing out the hours from one to twelve. Would a "three-minute" egg be hard boiled with this method of measurement; if the vessel was full; or empty? How would it be affected by a hot, or by a cold day? Yet, this was the conception of accurate measurement. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watthour meters.



NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

● SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS ●

RELIABLE Connectors



Save Time

by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

Save Copper

by using these connectors which are good as new after being salvaged.

EASY TO INSTALL
LOW IN COST

Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS

BULLETINS

data books, etc.

V-Belts and Sheaves (317)

A 44-page bulletin describes the Allis-Chalmers line of fractional horsepower Texrope V-belts and sheaves. Simplified engineering data for fractional horsepower drives and working formulas are included. The booklet is illustrated with photographs, drawings and selection tables.

Electronic Tube Chart (318)

A selection chart of electronic tubes for industry has been prepared by General Electric Co. In the two-page data sheet is information in tabular form on each type, simplifying selection of the proper tube for a particular application.

Relays (319)

General Electric Co. describes its Type HDD percentage-differential relays in a 12-page bulletin. This bulletin gives characteristics, construction and operation details. Diagrams and photographs.

Aircraft Motors (320)

A 28-page booklet issued by Emerson Electric Mfg. Co. describes its aircraft motors. Features of the motors, according to the manufacturer, are high-speed operation and light metal construction.

Cold Cathode Lighting (321)

In a bulletin on cold cathode lighting transformers, Acme Electric & Mfg. Co. defines the type of lighting, discusses its advantages and gives pictures and data on several installations.

Control Bus Batteries (322)

Electric Storage Battery Co. has a new handbook on control bus batteries. The booklet discusses the method of calculating storage batteries of switch gear control, capacity of storage batteries at various rates, effects of low temperature, methods and requirements of automatic charge control and necessary characteristics of motor-generator sets and rectifiers. Information includes types and sizes of battery racks and proper location of storage batteries.

Signal Systems (323)

Cannon signal systems for hospitals are described by the company in a 16-page booklet. Included are architects' specifications, wiring layout for a signal system and comparative catalogue numbers on the equipment.

Air Condensers (324)

Barker & Williamson in a four-page pamphlet gives information on its Type CX variable air condensers for heavy-duty requirements.

Safety Booklet (325)

A safety booklet is being distributed to its women employees by General Electric Co. This booklet is directed to women working on machines and in men's jobs.

Rectifiers (326)

General Electric describes Ignitron mercury-arc rectifiers for 501-kw. and higher ratings, 250 to 900 volts, in a 36-page bulletin recently published. Advantages, design and mechanical construction of these rectifiers is covered in the publication. Illustrated by photographs and diagrams.

Connectors (327)

Burndy Engineering Co. has a new catalogue of its Hydent connectors. The 64-page publication illustrates and gives data for various applications of these indent type connectors.

Turbosupercharger (328)

"They're Turbosupercharged" is the title of a booklet issued by General Electric in its series describing the company's history and research activities. This bulletin describes the construction of the turbosupercharger, points out where it differs from the geared supercharger and lists its advantages in aviation. Illustrated.

ELECTRICAL WEST, 68 Post St., San Francisco, 4, California

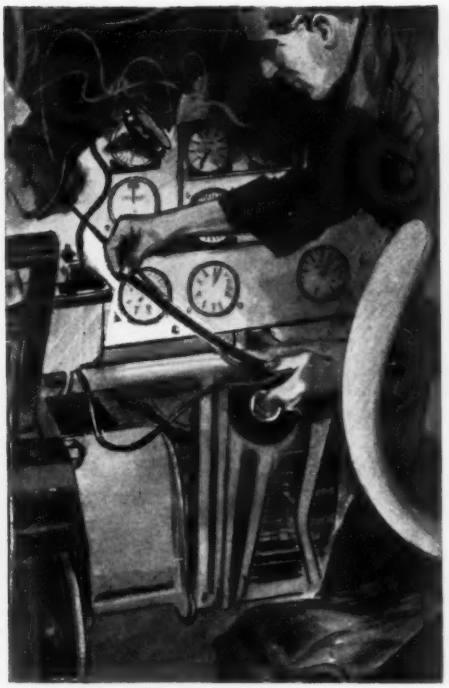
Please send me information about following CIRCLED items:

300 301 302 303 304 305 306 307 308 309 310 311
312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328

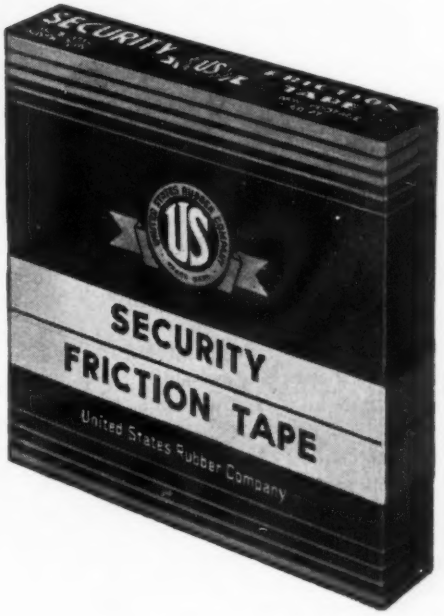
Name..... Company*..... Title*.....

Address.....

* Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.



HOW BIG IS TAPE? Just as big as the broken wire it restores to service—or the tank it helps to build. Big enough for it to be important that the Armed Forces and War Industries have first call on our production of U. S. friction and splicing tape.



FIRST AID FOR CANNIBALS

Down in the South Pacific, ground crews cheerfully turn cannibals...all for the sake of keeping planes in the air. A plane limps home after downing a Zero...scutters to a lameduck landing...and is immediately looked over by the "grease monkeys" and mechanics. Then...they turn cannibals. That's what they call the boys who snatch parts from planes to repair others. Other planes, too badly shot up to be flown again, are kept as a sort of salvage depot. Parts, from landing wheels to sparkplugs are used again in other planes...used again and again.

Right there is where tape comes in. Without it, many emergency repairs could not be made...wire could not be spliced...parts could not be fastened in place...planes could not again leave the ground.

A roll of tape in itself is a *mighty* little thing. But...in actual use by the Armed Forces, by war industries it gets as big as the job it is called upon to do.

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ELECTRA'S HUSBAND

Woman's Place Is—?

AN OFT-QUOTED saying of Dr. Johnson states that, "A man is better pleased when he has a good dinner on the table than when his wife talks Greek." Yet despite this inference that woman's place is in the home, a recent survey among feminine war workers has given tomorrow's planners in the electrical industry something to worry about. Thirty-five women in each 100 interviewed expressed themselves to the alarming fact that they had no intention of ever returning to the kitchen.

Even Electra agrees that this is a sorry state of affairs. It is like the miller's daughter refusing Rumpelstiltskin her first offspring after she had accepted his swiftly spun gold.

For thirty years inventive minds have rearranged the kitchen into a place of beauty, chrome-plated its equipment, yet many womenfolk seem to regard these efforts as so many false decoys. With swift and adventuresome wings they are headed south into the discordant and choppy seas of business. Where Grandma dozed contentedly in front of a black coal stove, or with hands clasped to show keen satisfaction at having baked an unscorched omelet in the Dutch oven, modern women, for reasons known only to themselves, decline the attractions of the finest kitchen the world has ever known.

It seems not important that tomorrow's kitchen tasks will be accelerated and refined. Nor can we believe that wives and sweethearts are unaware of new culinary thrills awaiting them. Oven-peeking is made unnecessary by the new all-glass range; meals will cook under pressure in less time than it takes to set the table; dishwashing will be a thing of the past; the walls contain health devices, and can be painted with illuminated designs at will. Yet a lot of women want none of it.

A glance at past literature anent the kitchen proves conclusively that straying from the hearth is no fault of the advertising man. Booklets skillfully couched in swooning rhetoric have pointed out that no woman with a pulse count under ninety could resist the new technique of freezing unit, or cooker pot. Testimonials and marvelously-colored illustrations of beef ring and carrot strips, copy penned in iambic pentameter have welcomed women into the little room that embraces the kitchen sink. Advertising men cannot possibly be blamed for women's exodus into industry. Women have forsaken the home because women are emancipated.

Women are tired of being a little lower than the angels, loved from afar while the better half is subduing nature and founding empires. Somehow she has gained the idea that it is her heaven-born duty to go out and reform the world, be a leader in society, and hum and hurry as she seizes an oil can for the purpose of alleviating the squeak of a hoist. The question that faces industry is this: What can be done about it?

What can be done to bring our stray lambs back into the fold? Between hours spent improving the sliding trays and the disposal unit, surely industry has need to recreate some of the spiritual values that gave contentment to women of yesterday. Perhaps the appeal is to be found in motherhood. Perhaps we need less rugged individualism, less collectivism, and more glamour to the family unit. If the numerous magic servants operated by electricity have encouraged women to want excess leisure, and completely escape the kitchen, then perhaps more emphasis need be placed on the creative results of kitchen activity. If the confines of kitchen walls have given women a sense of isolation, then perhaps consideration should be given to methods which will engender participation, which will make her "belong."

Planners for the industry must come forward with a solution to our dilemma. In the meanwhile a few concrete suggestions may be in order. For instance, where now the garage occupies the front of the house, it may be wise to let the kitchen overlook the street and install transparent walls so neighbors and passers-by may point with approval and respect to the fact that Mrs. Blank is busy in her kitchen. Again the kitchen needs more space. Not that we suggest a long plush seat to accommodate the weary postman, milkman or grocer boy, but the kitchen needs several soft chairs for the cocktail hour where friend hubby, accompanied by Joe and Bill, may sink in comfort and chat about events of the day while Electra prepares the evening meal. Such attention should flatter and please her.

It may be worth a second thought to install more mirrors and, in an era of factory grime, stress women's beauty. Perhaps spigots should be arrayed across the kitchen sink, corner drug store fashion, where Friend Hubby, Joe or Bill may push a valve and provide Electra with a bromoseltzer, hand lotion, or a dry martini. In the kitchen, too, "no stoop, no squint" still confronts the housewife. Perhaps small elevators can be installed in front of refrigerator and range so that Electra need not bend forward unbecomingly, but by pressing a button can descend into the floor until her eye is level with the electric thermostat, and ascend again as becomes an angel.

These simple innovations should raise woman from the state of subjection and make her co-ruler, a thing she desires. They give her temporary participation in the world of mighty man, and in the meanwhile we trust that planners for the electric industry will thing of something better. As a matter of fact, some of the wizardry of the electronic engineers could be devoted to kitchen glamourization.

OUR particular guest one evening recently had the reputation in Washington for his ability to define even the most complicated military situations in simple language. Strategy, he told us, was the plan; tactics, the execution of the plan and logistics, the supplying of the wherewithal to execute the plan.

"That lady," he said pointing to Electra, "knows what I mean. You call up from the office about three o'clock in the afternoon and announce that you are bringing a big customer from Chicago home to dinner. That's strategy. From then on she handles the logistics and tactics. She has to get all of the things which go to make up a creditable meal and then see that they are served in a manner in which both of you can take pride. So the logistics and tactics are her problem."

"Were my problem," Electra said. "Now I'd tell him to take them to a hotel, thus making me the strategist and giving him the tactics and logistics."

A woman may know nothing of either logic or logistics, but leave it to her to swing the tactics her way.

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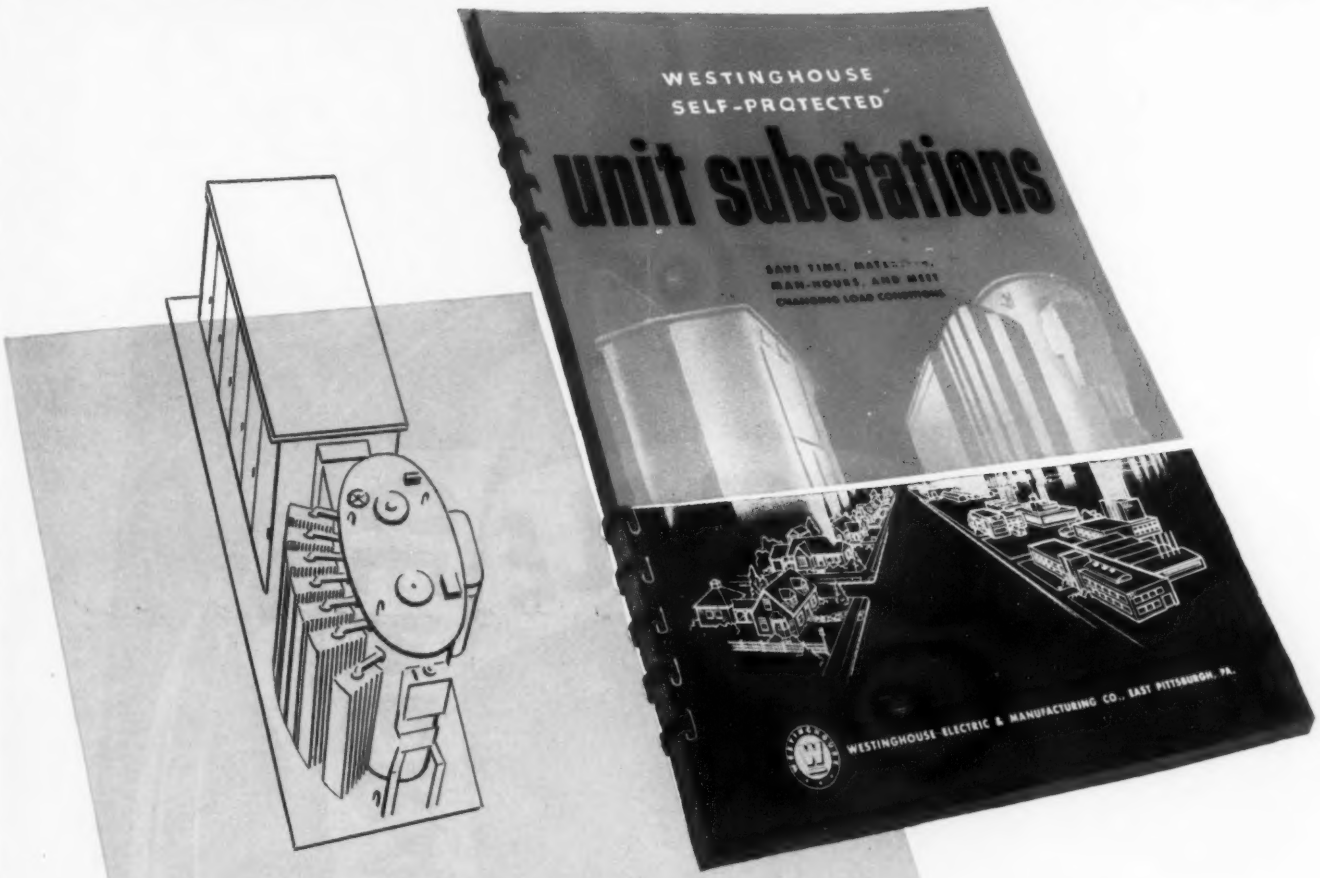

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1944, FEB. 17

TO OUR CUSTOMERS:

CONTINUING OUR SURVEY OF THE PRACTICES, CONDITIONS AND PROCEDURES THAT HAVE BEEN EXISTENT IN THE WIRE AND CABLE INDUSTRY OVER A PERIOD OF YEARS, WE ARE SATISFIED THAT THE ELIMINATION OF SOME OF THESE POLICIES CANNOT HELP BUT RESULT IN SUBSTANTIAL BENEFITS TO ALL BRANCHES OF THE ELECTRICAL INDUSTRY, TO ALL CUSTOMERS AND TO THE GENERAL PUBLIC. AS OUR STUDIES DEVELOP THE NEED FOR CORRECTIVE MEASURES, WE WILL, IN LINE WITH OUR CONSISTENT POLICY, PROMPTLY INSTITUTE SUCH CHANGES AS EXPERIENCE AND CONSIDERED OPINION WARRANT.

AT THIS TIME WE FEEL IT INCUMBENT UPON US TO ASSUME "CLEARANCE OF THE DECKS" IN RESPECT TO REELS, SPOOLS AND CASES WHICH ARE USED FOR THE SHIPMENT OF PRODUCTS OF OUR MANUFACTURE.

EFFECTIVE MARCH 1, ALL GENERAL CABLE CORPORATION CONTAINERS WILL BE SHIPPED ON A "NO CHARGE" BASIS AND NO PAYMENT OR DEPOSIT WILL BE REQUIRED.

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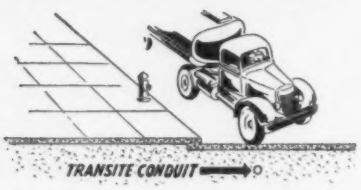

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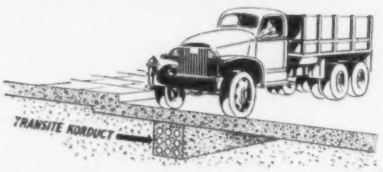

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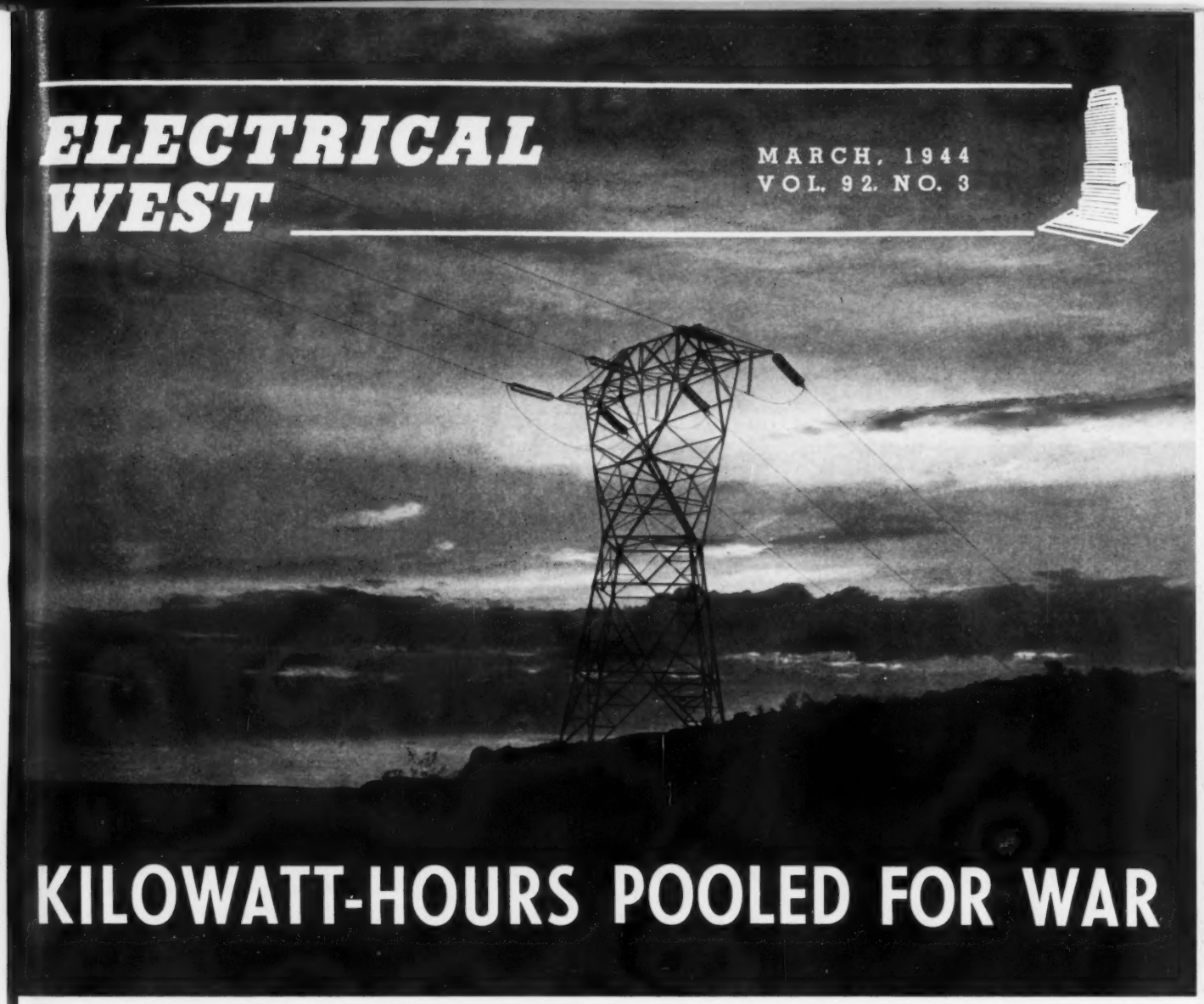
ELECTRICAL WEST

MARCH, 1944
VOL. 92. NO. 3



KILOWATT-HOURS POOLED FOR WAR

Walter C. Heston
Engineering Editor
ELECTRICAL WEST

WITHOUT building a single power plant, 135,000 horsepower of additional electrical generating capacity has gone to war in the Pacific Northwest through complete interconnection of all major power systems in a five-state area. This super power pool, which has harnessed every available kilowatt-hour of electrical energy and made it available wherever needed, is the Northwest's all-out power contribution to war production. It is a war drama with peacetime implications that can have a far reaching influence on the industrial future of this region.

This wartime pooling of 4½ million horsepower of electrical generating capacity into one of the world's greatest power reservoirs combines power resources of all private, municipal and federal systems in the states of Oregon, Washington, Montana, Idaho and Utah. Because of the great diversity of power resources of the eleven major systems that comprise the pool and the diversity or difference in character of loads and times of power demands it was found possible after the pool was formed to place 135,000 horsepower or 100,000 kilowatts of additional load on the combined systems. This is enough power to build one 10,000-ton Liberty ship every day, or turn out (censored) Flying Fortresses a day, or to produce 275,000 pounds of aluminum every 24 hours.

Besides this, the pool has enabled regions with little war load to pump surplus power into the 13,000-mile web of interconnecting power transmission lines and make it available where needed. It has saved the burning of thousands upon thousands of barrels of critical fuel oil and thousands of tons of coal by substituting hydro power instead from somewhere in the pool. Interconnection has also proved a good neighbor arrangement whereby all systems pitch in and help another that may be in trouble, perhaps due to storms. Systematic scheduling of shut-downs for repairs has been made possible so that no two large generating units are out of service at the same time, a very important factor in assuring maximum power output from all plants. A carefully worked out regional disaster relief program was also set up by pool members. Under this all available emergency equipment and personnel were listed and furnished to each member for use in case of disaster. This program went so far as to contemplate robbing equipment in service for spare parts if urgently needed to restore service elsewhere.

Pool Saves $25,000,000

Of even greater importance than the saving of $25,000,000, which would have been the cost of building a 100,000-kw. power plant and transmission lines, was the fact that this power was *immediately* made available for war production. Mere cost would have been incidental to the critical copper, steel, manufacturing facilities and manpower that would have been required, to say

nothing of the all-important factor—*time*.

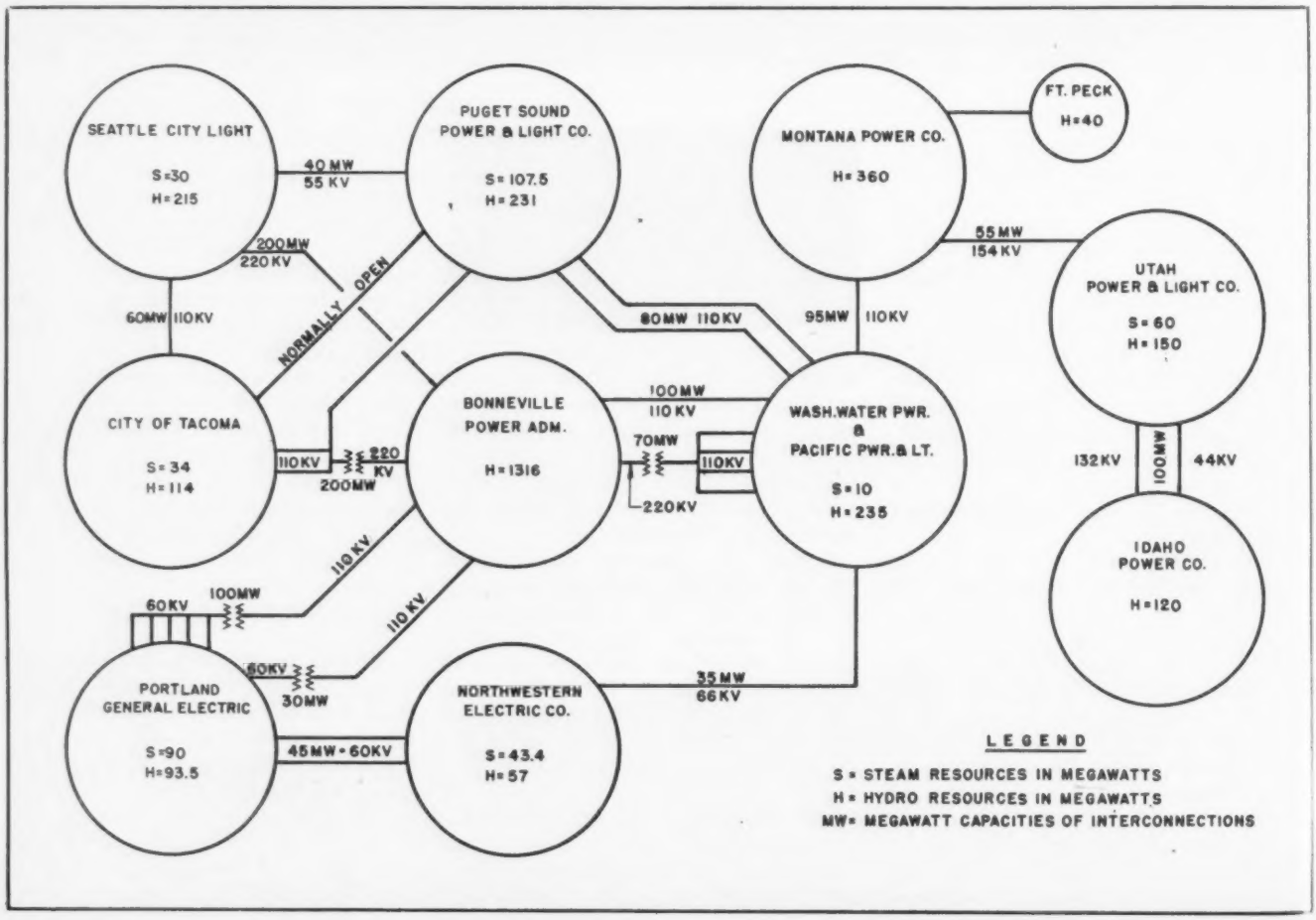
Yet the joining of a few power transmission lines between existing interconnected systems formed this super power pool and produced the equivalent of a 100,000-kw. power plant seemingly out of thin air. It does not mean that a power shortage was averted, because none was ever threatened, but it did permit just that much more war load to be centered in the Pacific Northwest.

This newly found 100,000 kw. of power all came about through what engineers call *diversity*, which is a technical way of saying that all of the eggs are not in one basket. Diversity means that there is a difference in power producing capabilities in the several watersheds encompassed by the pool. Precipitation and runoff vary greatly in these watersheds throughout the seasons of the year. If, for instance, there is a shortage of power in the Puget Sound region, then the needed energy may be supplied from plants in eastern Washington, Montana, Idaho or Utah, over this web of 13,000 miles of interconnecting high-voltage transmission lines.

There is another kind of diversity too, which is the difference in character of loads on the eleven major systems that comprise the pool. Maximum power demands do not occur at the same time on each system and when all systems are interconnected, the peak demand of the combined systems, or the pool, is considerably less than the sum of all the individual system peaks. Further benefit from this type of diversity is gained by the fact that the systems are in different time zones, extending as they do over an area roughly one-sixth that of the entire nation. Systems peaks are staggered as much as half an hour as a result.

This vast reservoir of electric power, that has harnessed together more than 4½ million horsepower, intrigues even the imagination of the engineers who created it. Its potentialities are so great and it portends such a promising future for the power industry of the Northwest that its full possibilities are not yet fully explored. Yet the power companies of this region, who pioneered in interconnecting their systems for mutual benefit, had themselves for years been designing the pattern for this great interconnection of systems and complete pooling of all power resources in the five-state area.

Circle diagram of Northwest power pool. Generation figures in megawatts in some cases are name-plate ratings and in other cases are overload capacities. Tie-line capacities are in some cases limited by transformers at tie points; or system stability, losses, or voltage levels may be limiting factors



History of Interconnection

Tying together of the private power systems of the Northwest began way back in 1915. When the Milwaukee railroad was electrified in 1918, and the systems of The Washington Water Power Co. and the Puget Sound Power & Light Co. were tied together through the railway's 110,000-volt transmission line, interconnection took its first big forward stride. The municipal systems of Seattle and Tacoma were interconnected in 1923 for mutual aid and, in 1938, Puget Sound Power & Light tied in to form a three-system pool.

The Washington Water Power Co. and the Montana Power Co. were interconnected in 1923; Northwestern Electric and Portland General Electric in 1925; Utah and Idaho Power companies in 1928, and Northwestern Electric, Pacific Power & Light and The Washington Water Power Co., in 1930. When, in 1941, a 154,000-volt line was built to tie in Montana Power and Utah Power, there was formed a six-company pool of the Electric Bond & Share Co. systems in Oregon, Washington, Montana, Idaho and Utah. This pool operated for more than a year before the larger pool was formed. Operating technique that had been worked

out and the resource data that had been compiled in this operation assured success of the larger pool from the start.

Bonneville joined Seattle and Tacoma in 1941. In July of 1942, the radiating transmission lines from the Bonneville and Grand Coulee power projects, operated as the Bonneville Power Administration, were tied into the existing web of transmission lines to form the present eleven-member super pool. One hundred and fifty power plants, 130 privately-owned and 20 publicly-owned, make up this great power reservoir with generator rating of 3,353,500 kw. or 4,500,000 hp. Approximately 2,933,500 kw. of this is hydro and the balance, 420,000 kw., is in steam generating capacity.

These eleven power systems are grouped into ten units for purpose of pool operation and comprise: Portland General Electric Co.; Northwestern Electric Co.; Tacoma City Light; Seattle City Light; Puget Sound Power & Light Co.; Bonneville Power Administration; The Washington Water Power Co., and Pacific Power & Light Co., operating as a unit; Montana Power Co.; Utah Power & Light Co., and the Idaho Power Co. Several other important sources of generation are represented by some one of the pool members, such as Eugene, Ore., and Centralia, Wash., municipals, represented by Bonneville. In addition there are a number of industrial power plants, including sawmills and pulp and paper mills, that feed appreciable amounts of power into several of the pool member's systems and thus are doing their bit for war power, too.

A glance at the accompanying diagram will give some idea of the complexity and magnitude of this interconnected system. It extends from Portland and Seattle on the west to Fort Peck, Mont., nearly over to the North Dakota border, and to Salt Lake City on the east. Transmission distance from Portland or Seattle to Salt Lake City is 1,100 miles. The interconnection extends 900 miles from east to west and 800 miles from north to south.

What brought about formation of this power pool, why is it so noteworthy and of such great economic importance and how does it operate?

Voluntary pooling of Northwest power resources through interconnection immediately released 100,000 kw. for new war loads. $25,000,000 was saved. More important was the saving in critical materials and manpower. Vital fuel oil and coal were conserved. Scheduling of maintenance outages in five-state area made possible. Continuity of power supply was assured and disaster relief program set up.

Democracy Fosters Cooperation

One thing the European and Oriental mind cannot understand is how we in this country, with our competitive enterprise system under democracy, can so quickly and cooperatively put over a great undertaking. Free people with incentive can accomplish far more than a regimented people being driven. Our amazing war production in only two years time is ample proof. The cooperative spirit between private power interests, municipal power systems and representatives of the federal government, that functioned so harmoniously to form this great Northwest power pool, is still further evidence.

Any diverse political opinions that may have existed were subjugated to the one aim of winning the war. Secretary Ickes of the Department of Interior did not have to order this to be done. J. A. Krug of the Office of War Utilities did not have to issue an edict, but when he suggested the desirability of pooling all power resources in the Northwest by complete interconnection of all systems, the wheels were set in motion and this super power pool was created.

Many of the private systems had been operating interconnected for more than 25 years and power was regularly moved back and forth between systems. When the war came along and created demands for all the power the Northwest could conceivably produce, it required only a few and comparatively inexpensive further ties between systems to create the Northwest power pool. Thus, in July of 1942, this pool came into being and has been operating successfully since that time.

The pool can be likened to an immense water system with a number of reservoirs all intertied with an extensive pipe line system, to which there are connected a number of steam pumping stations that may be used to pump water into the system from wells to augment supply in case there is a shortage of water in the storage reservoirs. From this system would be served the needs of cities, industrial plants and the farms.

If there were a water shortage in Montana, water might be pumped into the system in the Portland area and shoved along toward Spokane, and a like amount of water from the Spokane region passed on along to Montana. Likewise, if there is a shortage of power in Seattle, coal may be burned under boilers of steam electric stations in Salt Lake City, and the power pushed along from one system to another so that it immediately becomes available in Seattle to build ships and Flying Fortresses and to cook some war worker's dinner on an electric range.

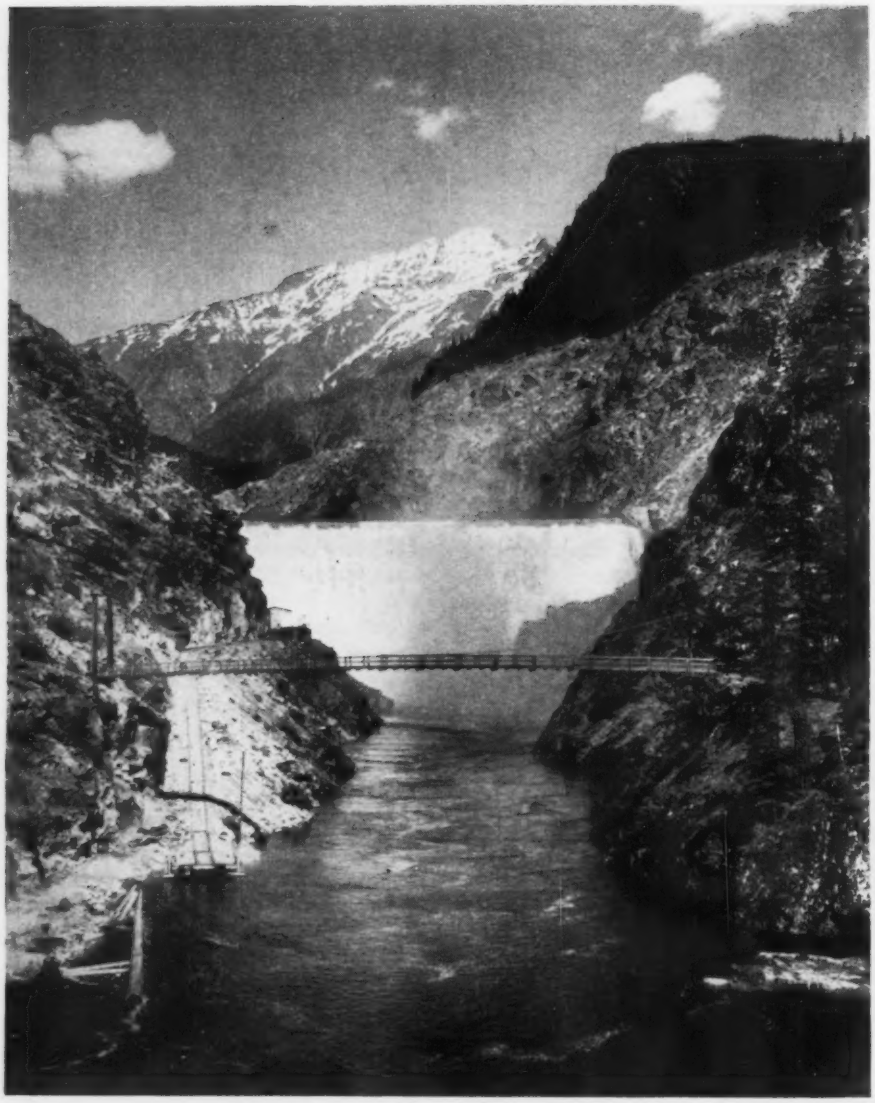
In other words, power is pushed around in this interconnected electric system just like the water would be pushed around in the water system, seldom traveling any great distance.

Great Diversity

The diversity between hydroelectric power resources of the pool is tremendous. Many of the plants are located on streams that flow into the Pacific from the western slope of the Cascade Mountains. Several of the largest plants of the pool are located on the Columbia River or its tributaries, including Rock Island of Puget Sound Power & Light and Grand Coulee and Bonneville on the Bonneville system. There is great diversity between the two main branches of the Columbia itself. One main fork rises in the Canadian Rockies and the other, the Snake River, rises in southern Idaho, the headwaters of the two being some 800 miles apart and in areas of entirely different rainfall and snowfall characteristics.

Then there are the plants of the Montana Power system, several of which are located on the Missouri River that finds its way finally into the Gulf of Mexico at New Orleans via the Mississippi. Plants in Utah are located on streams that empty into Great Salt Lake in still another large drainage area.

Precipitation varies widely in the great drainage area of the many watersheds that produce power for the pool. When there is a low water year in Montana, there may be ample water on the Pacific Coast, and power can be sent into Montana from the west. Under present pool operation, power is shifted back and forth in such a way as to take full advantage of this great diversity in water resources and also to use all available hydro power be-



Hydro — Steam — and Transmission — the three basic elements that go to make up the mighty Northwest power pool. Kilowatt-hours from hydro resources like those of Seattle City Light on the Skagit River are pooled with steam generated energy from such plants as Jordan of Utah Power & Light through a network of 13,000 miles of transmission of which Bonneville's 220-kv. lines are an important link

fore critical fuel is burned in steam electric stations.

Moreover, the pool is used most effectively in supplying unusual power demands in one area by drawing upon resources in some other part of the pool. For instance, the Idaho Power system, with very little war load and considerable surplus hydro, for periods of time has pumped into the pool by way of the Utah Power & Light system as much as 80,000 kw. Thus, the comparatively small Idaho Power Co., way off on the end of the pool, is performing a tremendously important service by making a part of this power at least, available on the Pacific Coast with its heavy war loads.

The fact has been mentioned that the systems are in different time zones. Montana, Utah and part of Idaho are on Mountain time, while the rest of the territory is on Pacific time and this staggers periods of peak power demands as between systems. Darkness travels from east to west at the rate of about a thousand miles an hour and system lighting peaks pass along westward with darkness. This means that as darkness falls in Montana and Utah, if the systems in these areas are short of capacity to meet their peaks, power will flow in the reverse direction, that is from west to east and then as the peak sweeps on westward a wave of power would follow along with it. Almost an identical parallel is the case of a freight train on the electrified Milwaukee Railroad entering the electrified zone in eastern Montana. Power would rush east to meet the demand of the train, perhaps 10,000 hp., and then a wave of power, as it were, would travel along with the train as it proceeded westward to the Coast.

If the needs of the systems in the Mountain time zone were say 40,000 kw. above normal load to meet their peak power demands at 6 p.m., then because it is only 5 p.m. in the Pacific time zone and the peak there not yet reached, there is capacity to spare and the 40,000 kw. can be passed along east. When the peak in Oregon and Washington is reached at say 6 p.m., it is now 7 p.m. in the Mountain time zone and the peak has passed and the 40,000 kw. can be pushed back to the Coast. Thus, the 40,000 kw. of capacity serves a dual purpose. This example is slightly fiction, but the principles involved are correct and it serves to show one of the important ways in which the formation of the pool released the 100,000 kw. The same generating capacity can serve several de-

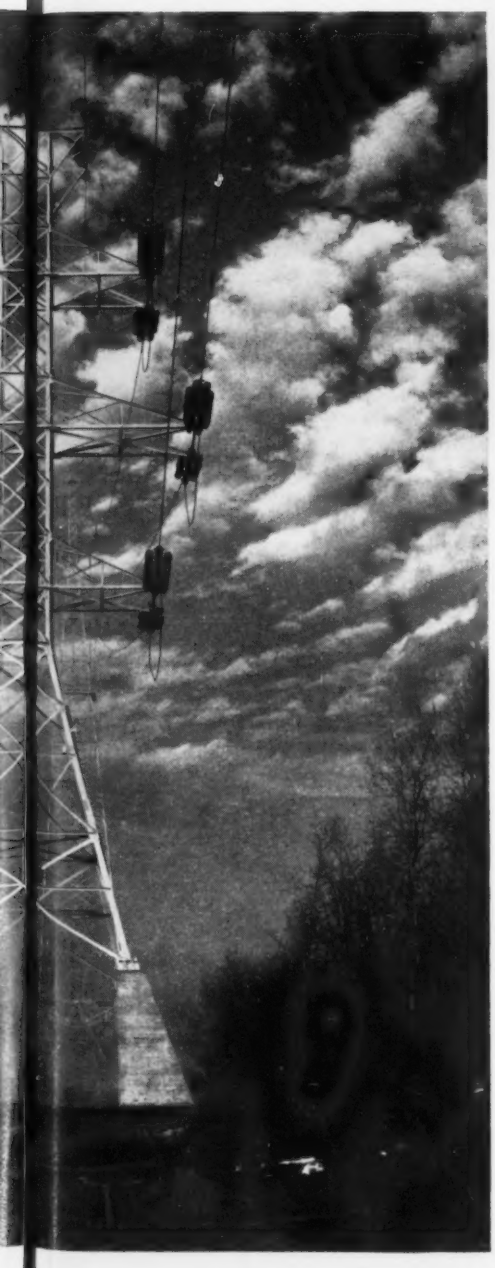
mands for power because the demands do not occur at the same time.

Principles of Operation

At the time the pool was formed there was developed a philosophy of operation without which many difficult situations might have arisen. As a guiding principle, the pool is considered as one immense system and every effort is made to operate it just as though it was under one management. This means that the most economical sources of power are utilized first unless there are some extenuating circumstances.

Twelve principles were adopted to govern pool operation as follows:

1. Interchange transactions are to be made in accordance with contracts between parties then in effect. However, these should not limit the ability of the pooled systems to realize the primary resources needed for carrying the primary load.



2. All parties should cooperate in order to provide capacity for carrying the maximum anticipated load of the pooled systems, after which economy of power production for the pooled systems should govern operation.

3. Each system should first reserve to itself as much of its own power and energy as is needed for its primary load without depending upon surplus interchanges with neighboring systems, and secondly, it should cooperate with adjacent systems to assist them in meeting their power and energy needs.

4. Delivery of surplus hydro or fuel energy should be in the following order of preference:

   a. First to the parties who currently need it to carry their loads after all of their resources are being utilized.
   b. Second to the parties who can use it to reduce critical fuel consumption.
   c. And third to the parties who can store it in controllable storage reservoirs to provide additional primary resources for the pooled systems.

5. Energy from steam stations should be utilized in the order of increasing relative costs, giving consideration to system losses in arriving at these costs, unless critical fuel conditions govern.

6. Losses in a system caused by interchange transactions are the difference between those losses that actually occurred and those that would have occurred had the transaction not taken place, or if the energy involved in the interchange had not been generated.

7. Energy in storage on a system for the account of another party is in that reservoir which would have been drawn upon if such energy had not been delivered for storage.

8. Each party having storage reservoirs has first rights to use of its own storage space, whether or not this space is occupied by water constituting stored energy of another party.

9. Any specific transfer of energy between two systems may be made in accordance with a prearranged schedule set up for a transfer, independent of meter readings. The algebraic sum of the hourly interchange meter readings for any one party represents the net of all transfers to or from that party during each hour.

10. Surplus energy sold by a party is in general the highest cost energy in that system produced for such sale, i.e., that energy which would not have been produced or purchased by that party if this interchange transaction had not taken place.

11. A party having surplus energy has the right to allocate this energy according to prearranged schedules among the purchasing parties directly connected to its system.

12. An interchange transaction can be made only between parties directly connected to each other and all interconnected systems that may be affected will be given notice of such a transaction. Interchange transactions will be limited to the capacity of the interconnected network.

These principles of operation have guided the pool from the beginning. One of the secrets of successful operation of the pool is that everything done is on an entirely voluntary basis. Nothing is compulsory. Each operator can do with his system as he wishes. However, no arbitrary stands have been taken and a tribute must be paid to members of the pool for their fine spirit of cooperation. The pool functions just as though it were one large system and thus maximum benefits of pooling have been attained.

Operating Organization

Administration of all matters pertaining to pool operation are in the hands of an operating committee composed of one authorized representative from each of the eleven pool members. Each representative has been given full authority by his management to act in all operating matters and this absence of executive interference permits the committee to decide operating matters on an engineering and economic basis without interference. Experience has shown this policy to be another important factor in successful pool operation.

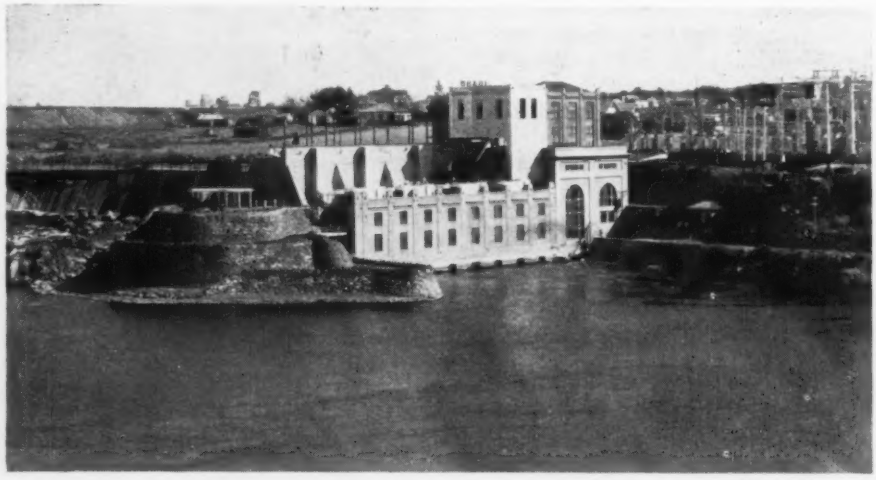
Meetings of the operating committee are held about once a month and are rotated throughout the territory. Each representative is privileged to bring with him such members of his own organization as he may elect when special problems are to be discussed. In addition to the authorized representatives and these consultants there is in attendance also the coordinating committee, mentioned later. At these meetings operating policy is discussed and decided; maintenance schedules are set up; telemetering and communication problems are worked out; plans are made for the elimination of bottlenecks and any operating bugs that have arisen are threshed out. A real effort is made to solve each problem or to lay plans for its solution. Minutes of these meetings are prepared by the coordinating committee and a copy is sent to each authorized representative.

Successful pool operation depends upon maintaining close contact and comparing of notes between operating committee members, dispatchers and the coordinating committee. In addition to these monthly meetings of the operating committee there is a weekly Bell telephone conference call presided over by a member of the coordinating committee with all parties concerned "sitting in." Each pool representative reports in turn on conditions on his system, resource outlook, maintenance outages desired and brings up any current problems for discussion. These telephone conferences have proved a highly satisfactory means of further coordinating pool operation.

An indispensable factor in smooth running of the pool is the work of the coordinating committee. This consists of four full-time engineers located in a central office who are kept busy with resource studies and coordinating and supervising pool operation. One of the members of this committee acts as chairman of the operating committee meetings.

The first duty of the coordinating group was to make resource studies of the pool from data largely supplied from long years of records of the individual pool members. Graphs were worked up for each system's resources and loads over a period of years and this supporting data was then used to make a master resource and load graph for the pool as a whole. This study is shown in one of the accompanying illustrations. From this study there was determined the most critical water year for the pool as a whole and, based upon this, a two-year operating program was set up. This program is under constant scrutiny and is revised at least annually.

Included in this study is the estimated operation of fuel burning plants and a so-called "rule curve" for each reservoir in the pool. This rule curve is a day-to-day schedule of reservoir elevations to be maintained and governs each system's operation. By adhering to these rule curves, each member is utilizing his resources in accordance with the coordinated operating program for the pool as a whole, and thus nothing is done to upset the master plan as laid out by the coordinating group and approved by the operating committee.



Large blocks of energy from plants of the Idaho Power Co., like the 36,000-hp. American Falls plant shown here, are transported via interconnected systems to war industries in Portland and Seattle, more than 1,000 miles away

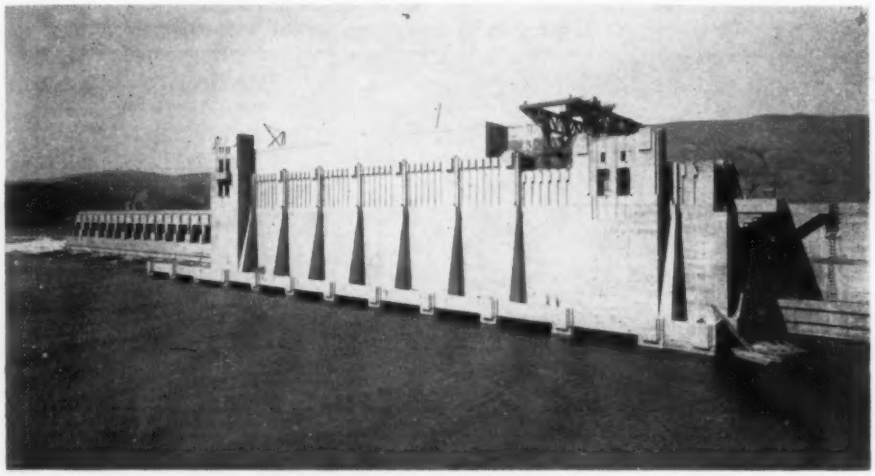
From the load and resource studies for each load area that goes to make up the over-all study for the pool as a whole, it is possible to determine far in advance any possible power deficiencies due to adverse water conditions and to lay plans to meet them and to anticipate and eliminate possible transmission bottlenecks that might develop should the condition occur. Plans are made so that the total load of the total area can be carried in the most adverse water year, but the operating program is so arranged that should the most probable water year occur, then the least use of critical fuel will have been made.

Resource studies had shown that the most critical period in the pool's operation would come late in 1943, the winter just passed, and that the peak load would come within about 100,000 kw. of combined generator rating.

With total generator rating of 3,353,500 kw., this allowed a margin of less than 3%, too small for comfort but nevertheless a workable leeway, everything considered. At the time of this writing the critical period had passed and the pool had acquitted itself most creditably and had vindicated the good judgment and planning of the coordinating and operating committees.

Storing of Water

If it were not for the conciliatory spirit of every member of the pool, the matter of storing energy in each other's reservoirs could have raised some serious obstacles. If evaporation, and gain or loss in hydrostatic head had been taken into consideration, the problems might have become hopelessly complicated. As it is, energy is freely transferred back and forth in reservoirs simply as so many kilowatt-hours.



Power development on the Columbia River began nearly 15 years ago with the Rock Island plant of Puget Sound Power & Light. Run-off characteristics of the Columbia are entirely different from streams west of the Cascades

Certain rules had to be set up to govern this practice. One of the most important of these stipulates that no energy is to be stored for the account of any pool member without an agreement covering all phases of return, sale, use and spillage. To avoid the premature utilization of critical fuel, power is frequently loaned from a reservoir on the promise that it will be returned at a later date. In other cases, power may be sold or temporarily stored in another member's reservoir to utilize water that otherwise would have to be spilled.

As a basic philosophy of pool operation, no water is spilled that can be converted into power and stored in a reservoir somewhere in the pool. Oftentimes steam generation, particularly from hog fuel burning plants, is used in order to store water in some reservoir as insurance against future water conditions.

This storing of water goes on all the time and is one of the chief advantages of pooling power resources. In some cases the storing party controls the stored water in the reservoir of a second party and in other cases the party owning the reservoir controls the water regardless for whom stored. In any event, unavoidable spillage liquidates the account, sometimes in the order in which the several parties have stored the water and sometimes in the order of cost of the power that caused the water to be stored. Always the highest-cost energy is spilled first.

How Water Is Stored

An example serves best to illustrate how this storage is accomplished. Assume that the Portland General Electric Co. has an excess of hog fuel or sawmill refuse at its Station L steam plant and wishes to turn say 20,000 kw. of this into electrical energy and store the equivalent water in the Ariel reservoir of Northwestern Electric, with whom it is interconnected. Portland General picks up 20,000 kw. of Northwestern's load in the Portland area and Northwestern drops 20,000 kw. of the load it was carrying on its Ariel plant. The water required for the 20,000 kw. at Ariel, no longer being used, is left in storage. The water thus stored is in terms of the kilowatt-hours represented by the reduced 20,000 kw. of generation, which has been carried on the PGE steam plant.

For the uninitiated, load is picked up or dropped by a steam-driven or hydro-driven generator by manipulating the governor of the steam turbine or water wheel so that the machine *tends* to increase or decrease its speed. Speed does not change in terms of a few revolutions a minute, but only tends to change, because the electric generator is in synchronism or "in gear" with the electric system and cannot change its speed.

Where surplus water on one system is stored on another, the process is similar to the example cited above. One system carries so much load of another's and the equivalent water is stored in some designated reservoir.

In the Portland General-Northwestern transaction cited, PGE might say that it had so much hog fuel or steam in Ariel reservoir, and if the reverse of the power exchange had taken place, Northwestern could say that it had so much hydro in the hog fuel pile of PGE. Such expressions as so much hydro in someone's hog fuel pile, so much oil or coal in another's reservoir may sound strange, but such pool jargon is an expressive way of clearly indicating the source and cost of the energy stored.

A reservoir might have energy stored in it for the account of several pool members with, figuratively speaking, a conglomeration of oil, coal, hog fuel, steam, hydro and kilowatt-hours in it. For clarity it is convenient to think of the energy represented as being stored in layers of water in the reservoir. In any event, when utilized or spilled it is all just plain water after all.

Load Factor Operation

An excellent example of how the pool functions to conserve water resources, save critical fuel and make power available where needed is by what is termed load factor operation. Individual systems have always practiced load factor operation by utilizing stream flow hydro plants during the early morning hours when system load valleys occur and shutting down other hydro plants to store water. Some of the West Coast systems have cheap hog fuel or sawmill refuse and a steam plant may be operated to utilize surplus fuel and a hydro plant shut down or operated on reduced load in order to store water.

With the pool the operation is identical, excepting that the plants will be on different systems, perhaps widely separated. At certain seasons of the year the stream flow plants of Puget Sound Power, for instance, will be operated at full capacity and several of the plants on the Washington Water Power system with controllable storage will be shut down, notably the Long Lake and Chelan plants. Night after night many of the plants on the Water Power's system will be shut down one by one and then started up again the next morning and the nighttime stored energy pumped back into the Puget

Sound system as its load requires.

A fine example of load factor operation is going on as this issue of ELECTRICAL WEST goes to press. Utah suffers from a shortage of coal along with the rest of the nation and every pound of coal must be conserved. This has made it imperative to operate the interconnection with the Montana Power Co. at maximum loading. Montana does not at present have energy of its own to maintain constant delivery over the line and is doing a nice job of load factor operation by absorbing large blocks of off-peak energy from the west and redelivering it to the Utah system on its peak. Montana Power is maintaining constant delivery on the interconnection by pulling down its reservoirs in the heavy-load periods and then reducing the output of its plants below its own load during the light-load periods, taking otherwise unusable power from the west to refill its ponds.

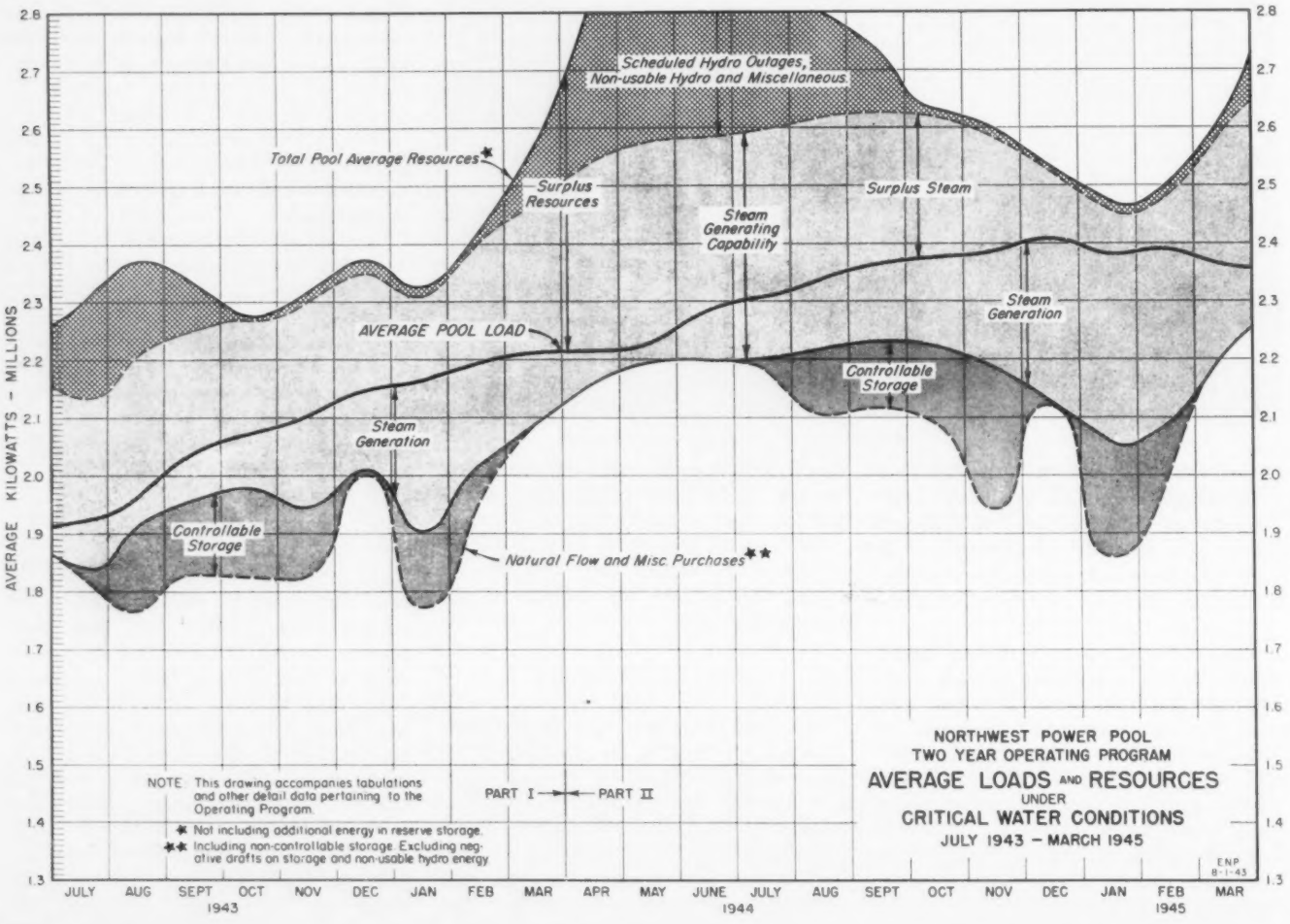
The needed power from the west for this operation is supplied by the Washington-Pacific system which in turn receives it from Bonneville and retransmits, or wheels it, to the Montana system. In addition, the Washington Water Power system is absorbing an additional large block of off-peak power throughout the week and is holding its own reservoirs by use of this otherwise unusable power.

Bonneville, in turn, because of the difficulty of regulating the flow of the Columbia River, where it takes four or five days for water passing through the Coulee plant to reach the Bonneville plant, and with several large tributaries in between, is being aided in its peaking operations by help from other pool members, particularly Seattle and Tacoma municipals and the Washington Water Power and Montana Power companies.

By the operation above outlined, power that would probably go to waste during the light-load periods is being used to maintain a continuous maximum delivery to the Utah system, thereby saving several hundred tons of coal a day through the use of generation and transmission facilities of Montana, Washington and Bonneville. While Utah Power & Light is the beneficiary at present under this operation, there are times of the year when it and the comparatively small Idaho Power Co. perform an equally important service by pumping large blocks of power into the Montana system for delivery through the Washington-Pacific system to war plants in Portland and Seattle. The Eugene, Ore., municipal plant has burned hog fuel to save oil in Seattle. Seattle City Light has operated steam to help out Portland General Electric Co., and many other cases might be cited to show how the pool has operated to save fuel or make hydro resources go around.

This same load factor operation discussed is also used to take up the slack in changes in discharge from major reservoirs where it takes several days for the water to reach the last plant on the river. Bonneville has been mentioned and the same thing occurs with some of the plants on the Montana system where there is a three- or four-day delay. Other systems, too, have the problem to a lesser degree.

Through load factor operation then, peaking capacity of the pool is greatly increased, use of high-cost steam is minimized and stream flow plants are utilized to fullest advantage. Very few of the coastal streams have favorable damsites for large storage reservoirs, yet there are a number of large reservoirs, many of them natural, east of the Cascade Mountains which are util-


Scheduled Hydro Outages, Non-usable Hydro and Miscellaneous
Total Pool Average Resources*
Surplus Resources
Surplus Steam
Steam Generating Capability
Steam Generation
AVERAGE POOL LOAD
Controllable Storage
Steam Generation
Controllable Storage
Natural Flow and Misc. Purchases**
AVERAGE KILOWATTS - MILLIONS
NORTHWEST POWER POOL
TWO YEAR OPERATING PROGRAM
AVERAGE LOADS AND RESOURCES
UNDER
CRITICAL WATER CONDITIONS
JULY 1943 – MARCH 1945
NOTE This drawing accompanies tabulations and other detail data pertaining to the Operating Program.
PART I
PART II
* Not including additional energy in reserve storage.
** Including non-controllable storage. Excluding negative drafts on storage and non-usable hydro energy
ENP 8-1-43
JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR
1943
1944
1945

Master load and resource graph for two-year operating program of Northwest power pool. Similar graphs were made for each of the eleven systems comprising the pool. These forecasts are revised at least once a year

Water formerly unavoidably spilled from Polson Dam on the Montana Power system and that eventually found its way into the Gulf of Mexico at New Orleans, is now converted into electrical energy and made available wherever needed in a five-state area through pooling of resources by interconnection of all major power systems

ized to store surplus energy from the coast. Thus, pool operation of these Northwest systems that cover such a large area conserves water resources by taking advantage of this ability to store energy in the form of water. Pool operation is a mutual aid proposition all the way around and there is not a single system in the pool that could make maximum use of its generating facilities and resources if entirely on its own.

How the Pool Operates

Controlling the energy in a Goliath such as this super power pool requires high operating skill and expert dispatching along with careful scheduling of power interchanges. It is like a lot of weights held together by rubber bands. If everything is kept in equilibrium all is well, but if something happens or an operator does the wrong thing, the ties may break and the pool will go to pieces. Not irreparably so, of course, but tie lines open up and it takes from a few minutes to perhaps an hour or longer to get the systems synchronized with speeds just right so the gears, as it were, will mesh and the interconnecting lines will go back together to re-form the pool.

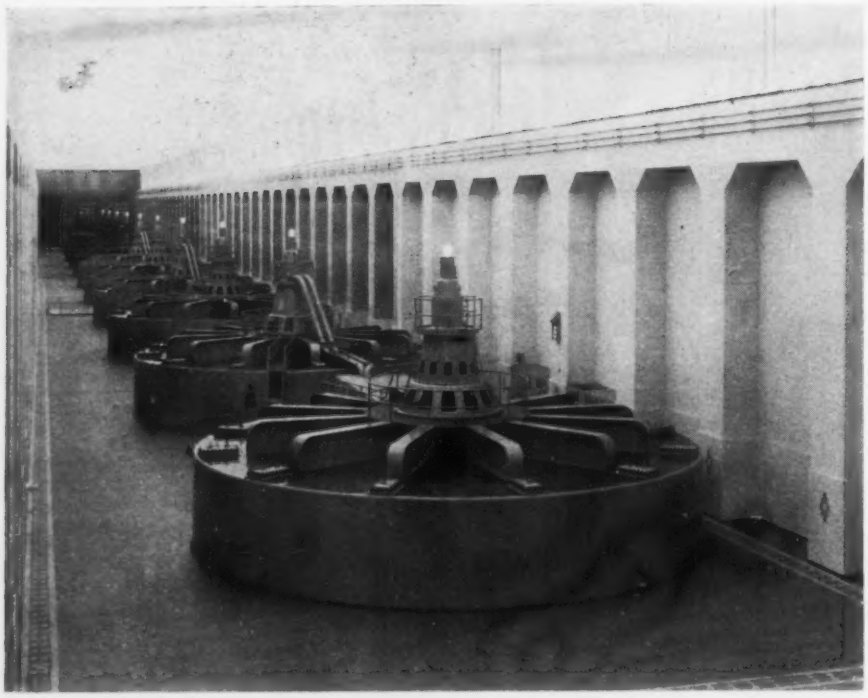
Engineers know just how much these rubber bands will stretch—how much the shafts connecting all these flywheels will twist before they will break, and they try to operate within these limits. They know just how much power each interconnecting tie line will carry before it becomes electrically unstable and opens up and separates the systems.

To aid in predicting results, many tests simulating operating conditions and transmission line faults were made on a-c calculating boards. If Bonneville's analyzer board would not handle the problem, it was then taken to the larger board of one of the electrical manufacturers for solution. The pool itself is often used at nights or on Sundays to try out anticipated operating conditions to see if any bottlenecks are going to develop when the conditions actually arise. If so, steps can be taken long in advance to remedy the situation.

Engineers are aided in operation of the pool by many automatic devices, such as telemetering and automatic tie-line load control and frequency control apparatus. Without such equipment, it would be difficult indeed to operate the pool successfully. Fast and reliable communication is, of course, imperative.

Some one plant, usually Coulee on the Bonneville system, is delegated to control speed or frequency of the pool. This plant was selected because of its 108,000-kw. generators. About 90,000 kw. of capacity normally will handle load swings, but at times two of the

One of the important steam "pumping" plants of the pooled systems is Station "L" of Portland General Electric. Supplied with hog fuel from "Mt. Osborne," this plant is used to conserve hydro resources at far distant points



Columbia River power from the now completed Bonneville federal plant with installed capacity of 518,400 kw. is fed into the Northwest power pool to build ships and planes and produce aluminum

large generators are put on frequency control. On occasion, the Long Lake plant of The Washington Water Power Co. controls frequency. Both of these plants are near the center of the pool and have the necessary automatic equipment. Variations in frequency are less for the pool as a whole than formerly under separate system operation. Time error of electric clocks against standard time is about the same under either of the methods.

Scheduling Interchanges

Scheduling of interchange of power is on an hourly basis for each 24 hours of the day. *Basic unit of time for all transactions is 60 minutes.* Each operator estimates his load and makes up his schedule for the desired receipts and deliveries a day or more in advance and exchanges these with his neighbors. Schedules are on the basis of megawatts, or thousands of kilowatts. The algebraic sum of the scheduled amounts gives the operator his net system interchange for each hour.

If an operator schedules 40 megawatts "in" for a certain hour, it means that, if an average of that much power comes into his system for the hour, he will have received 40,000 kwh. (40 megawatts or 40,000 kw. for 1 hour = 40,000 kwh.) His log sheet is in two parts. One shows the *actual* interchange as determined from the algebraic sum of the watt-hour meters on his tie lines, and the other shows the *scheduled* interchange. Any plus or minus from the scheduled interchange, is called the "deviation". Systems are operated from day to day and hour to hour to keep the deviation small and tending toward zero for reasons that will appear later.

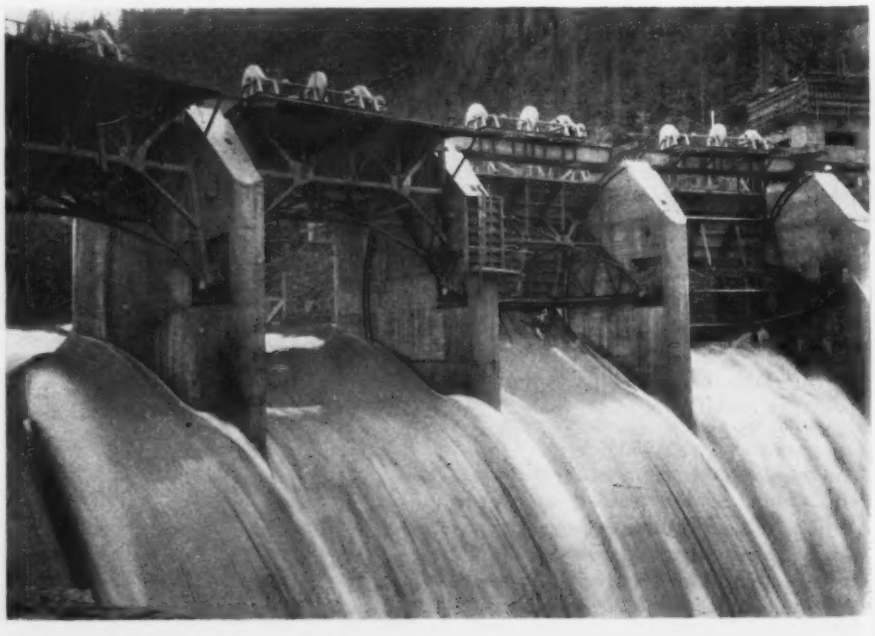
It will be seen that if an operator schedules 40 megawatts with another system for a certain hour and the deviation for that hour is zero, then 40,000 kwh. will have been exchanged exactly, right down to the limits of accuracy of the watt-hour meters themselves. However, billing is on the basis of the *scheduled* interchange and, no matter how much more or less than the 40,000 kwh. is received, he still pays for the 40,000 kwh. just the same. This is reconciled by the method of accounting used, described later.

Without telemetering it is difficult to maintain these hourly schedules because the operator must wait until the end of the hour when all meter readings have been 'phoned in from distant points and results computed by clerks with adding and calculating machines, before he knows the net result, perhaps 20 minutes past the hour. Without telemetering, he is working pretty much in the dark. If operating with telemetering and tie-line load control, he simply sets the control at the beginning of the hour for the desired interchange and his regulating plant will so operate as to closely maintain the schedule. His instruments tell him at every instant how he is maintaining his schedules and the amount of his net system interchange and he can make corrections if necessary.

Accounting Procedure

Accounting for interchange is a complicated matter in a pool of this complexity. There are several ties between each system in the western portion of the pool with a number of loops, and loops inside of loops, and the electrical laws that govern power flows are not in accordance with ownership of lines. As a result, an operator having a schedule with a

In May of this year, water diverted by the LaGrande Dam on the Nisqually project of Tacoma City Light will be driving a new 40,000-kw. generator whose output will serve Tacoma's war loads and add to resources of the Northwest power pool. Alder Dam upstream from this diversion will operate a 50,000-kw. plant to be completed early in 1945. Cost will be $20,000,000



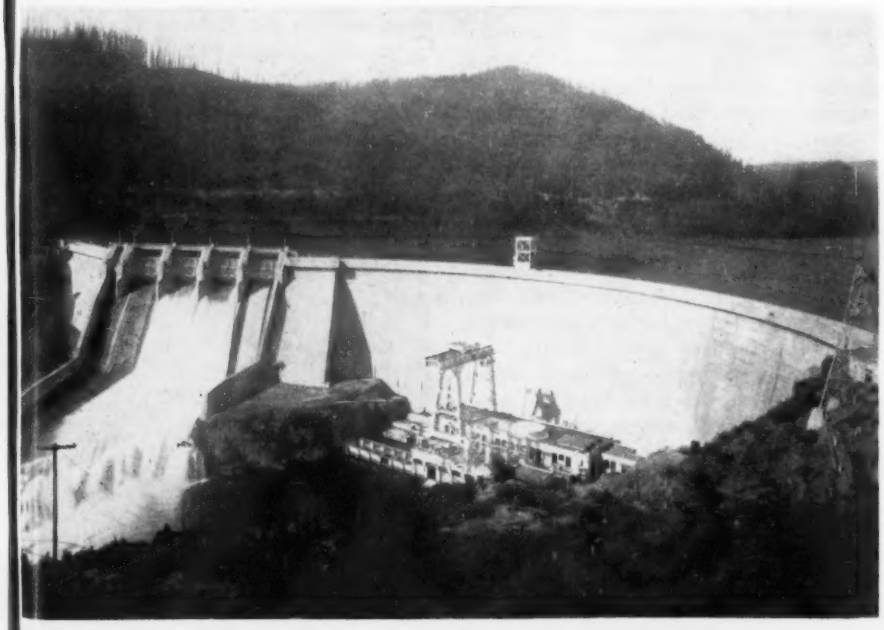
Grand Coulee Dam on the Columbia is the world's largest power and irrigation dam. Two power houses, one now practically complete with over 800,000 kw. installed, ultimately will produce 1,944,000 kw. Present combined installed capacity at Bonneville and Coulee plants constitutes more than one-third of the total generating capacity of Pacific Northwest power pool

neighbor may, and usually does, receive the power through one or two, or even three other systems not involved in the schedule. How then to untangle the kilowatt-hours that are all scrambled up in the pool and to keep scheduling and billing straight? On the face of it, the task appears almost hopeless, but fortunately is not as bad as it appears.

A rather unique method of accounting was devised. It is quite similar in all respects to a banking clearinghouse association, except that the pool's central coordinating group is not charged with the responsibility of accounting and billing. It does, however, keep a running check on pool operations and issues weekly reports that serve as a check on member's own accounts. Instead, each pool member uses his log sheet with its plus and minus deviations as his ledger sheet and his billing is confined to those members with whom he is physically interconnected and with whom he has contractual relations and schedules.

All systems operate with deviations and sometimes hourly deviations are quite large, although an attempt is made to keep them small and tending toward zero. Quite obviously, where system deviations are other than zero, then in a sense each member either "owes" the pool or the pool "owes" it. Actually, since the pool does not have a clearinghouse for this purpose, all accounts are balanced between systems having schedules and contracts with each other, which accomplishes the same purpose.

It will be seen that at all times the algebraic sum of all deviations for all systems in the pool must be zero. In other words, the "pool account" always balances and shows each system's debit or credit. When the deviation for any particular system is zero, then all debits and credits are wiped out and that member is square with his neighbors and hence the pool. Systems can be so operated that at the end of a month, or any time that may be desired, the deviation can be made exactly zero and the operator has received precisely the amount of energy he contracted to pay for under his schedules and has delivered exactly what he contracted to sell. There is no set price per kilowatt-hour for interchanges, this being determined by contracts between the parties.

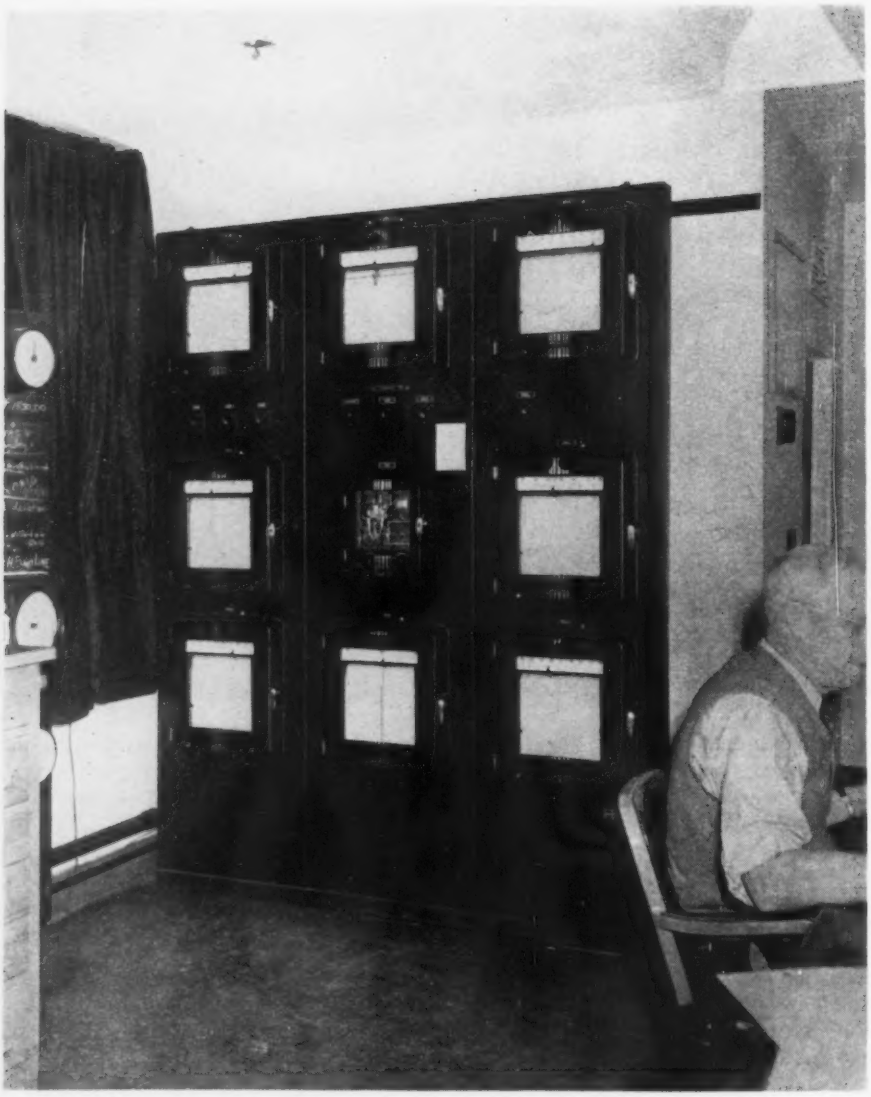


Highly diversified runoff of the Lewis River makes the Ariel plant of Northwestern Electric Co. a very valuable unit of the power pool for use in peaking and also load factor operation

Telemetering—Load Control

This telemetering, or transmitting meter readings from some distant point to a central dispatching office, is almost indispensable in the scheduling of interchange. One commonly used telemetering scheme consists of (1) an impulse-sending device consisting of a special commutator on the shaft of a watt-hour meter with revolving brushes so that impulses are sent out at a varying rate depending upon the speed of the meter, and hence the load being metered, (2) these impulses are sent to the receiving dispatching point over wire lines or over carrier channels on transmission lines, (3) the impulses are fed into a receiving device which converts them into direct current, and (4) this d-c is fed into the indicating meter where it is measured and recorded as megawatts.

Upon formation of the pool, all members agreed to install telemetering and tie-line load control equipment. At the time of this writing the pool was only about half equipped due to inability to obtain equipment. Fortunately the Washington Water Power system



Without telemetering and automatic tie-line load control, operation of the Northwest power pool would be most difficult. This installation of The Washington Water Power Co. was made during the early days of the pool and has aided in its successful operation

already had equipment on order for the six-company pool previously mentioned and was able to place its telemetering and automatic tie-line load control and frequency control equipment in service shortly after the large pool was formed. Because of the strategic position of this system at approximately the interconnection center of the pool, it has been able to assist Bonneville materially in frequency and load control and otherwise aid in successful operation of the pool. In fact, without it pool operation would have fallen far short of its present accomplishments.

The ultimate to be desired is for each system of a pool to be equipped with telemetering and tie-line load control and this is the goal toward which the Northwest pool is working. There are many benefits besides those already mentioned, one of the most important of which is that most systems would be able to carry their own peaks and thus avoid passing all the peaks from system to system on down to the frequency controlling plant with the attendant system losses. An extreme case would be the peak of the Utah Power system, for instance, being passed on up to the Montana system and from there to the Washington Water Power system and finally on to the Coulee plant on the Bonneville system, if Coulee was governing, as it usually does. This is a transmission distance of close to a thousand miles and would entail considerable losses.

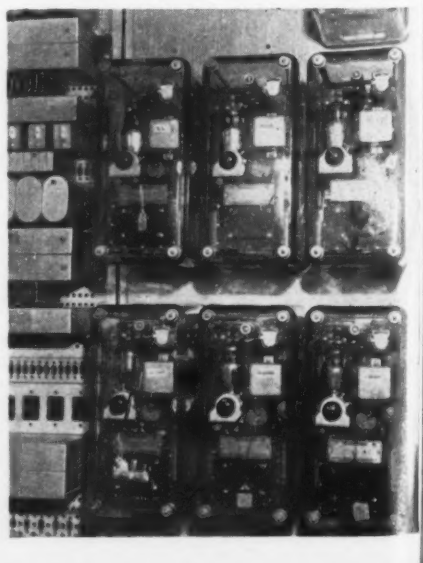
One of the accompanying photographs shows the telemetering and tie-line load control board in the dispatcher's office of The Washington Water Power Co., in Spokane. At the time the author took this photograph on the evening of Dec. 7, 1943, the system passed through its peak under automatic control without the dispatcher having to issue a single order and with each of four scheduled interchanges, and net system interchange, all preset, riding through exactly as the dispatcher had scheduled for himself the day before.

The schedule for the hour over the peak for this particular evening called for 60 megawatts "out" to Puget Sound, 10 megawatts "out" to Pacific-Northwestern, 20 megawatts "in" from Montana and 50 megawatts "in" from Bonneville. The algebraic sum of these quantities is zero, which meant that the "net system interchange" was scheduled for zero. That meant that the Washington Water Power dispatcher had scheduled himself to carry exactly his own load. Note, however, that 70,000 kw. was to come into the system and 70,000 kw. to go out. In other words, Washington Water Power would "wheel" 70,000 kw.

For his own system the dispatcher would operate his Long Lake and other plants at base or fixed load, and would govern or carry his own peak with his 54,000-kw. Chelan plant. If he had estimated correctly the day before, Chelan would just exactly reach full load on the peak—no more—no less.

It was really dramatic to sit in the dispatcher's office on this evening and watch the peak slowly come on and to see each curve drawing tie-line telemetering instrument tracing its red ink line exactly on the scheduled interchange and to see the net system interchange recorder resting exactly on zero. The load could be seen slowly to rise and rise on the Chelan telemeter—50 megawatts, 52, 53—until finally it indicated 54,000 kw., exactly full load on the plant, and the dispatcher said, "Chelan is wide open and we are square on the peak." In other words, he had hit it almost to the kilowatt.

These receivers convert carrier current impulses into d-c for operation of the instruments on the telemetering board



For perhaps five or ten minutes the load hung at 54,000 kw., and then gradually began to recede and the sun had set on another day of successful pool operation—all this without the dispatcher having issued a single order. He had everything at his finger tips. He knew what was going on at every instant on every part of this system—what his tie-lines were doing at interconnection points perhaps a hundred miles away. It was a nice piece of dispatching and goes to show how these old-time power men, with years of experience in pool operation, can handle their systems with perhaps half a million horsepower under their control, with a nicety of timing and judgment amazing to the layman.

The automatic tie-line load control mechanism is a most ingenious electrical and mechanical device that literally *thinks*. It does not become confused and "issue orders" to increase or decrease speed when the system is already tending in the right direction. Thus it prevents swinging or "hunting" of the pool with resultant increasingly heavier and heavier power surges through tie lines that would cause them to open up from overload and break up the pool. With manual control it is very difficult to keep the interconnected systems as a whole from going into long periodic swings, with sometimes disastrous results by cascading tie lines out and breaking up of the pool.

Operating Problems

Some mention should be made of the matter of power losses occasioned by interchange of power between systems and by the "wheeling" of power through one system to another. Operators feel that, with the ebb and flow of power in the pool, losses probably about balance out and that no one is being badly hurt and therefore each system is absorbing its own losses. However, this matter of losses may become a subject for study at a later date.

Handling of reactive power flows is a problem that has not been fully solved. An effort is made to confine wattless to the systems and regions where it originates, but this is not as simple as might be thought. Voltage levels or gradients must be properly maintained and this often entails limitations of apparatus not easily overcome. Several large synchronous condensers have been installed and a number of static capacitor banks put into service and these, together with carefully coordinated synchronous condenser operation and some segregation or splitting of station buses, have greatly aided in handling the problem.

Electrical instability of interconnecting tie lines has caused practically no trouble, largely because power limitations of ties were determined in advance on calculating boards or by using the pool itself for test and all serious bottlenecks were eliminated. Transmission and transformer bottlenecks develop from time to time and much has been done in their elimination.

Some oil circuit breakers were found to have insufficient interrupting capacity after the pool was formed and these were either replaced with larger breakers or were modernized to increase their rating. These, along with problems of telemetering, communication and others, are ironed out as they arise, but none have proved a serious barrier to successful pool operation.

Giant arresters like these protect high voltage lines of the power pool against one of their worst enemies—lightning

The Pool to the Rescue

A number of cases can be cited to show how the pool has supplied breakdown service or has performed to great economic advantage. Not to single out Tacoma City Light, because storms are no respecter of systems, but to show what pool operation can do in an emergency, there is the case of storm outage of both of the Lake Cushman lines. During the winter of 1942-43, a severe snow storm swept over the Olympic peninsula taking out both power lines from the Lake Cushman plants to Tacoma. So severe was the storm that by every means of patrol, including airplanes, it was impossible to find the break and make repairs short of three days. As it was, the people of Tacoma never knew the difference because the load was automatically picked up and carried by the pool, with only a momentary flicker when the Cushman lines first went out.

The pool is so great that large generating units and even whole plants can relay off the pool with hardly more than a ripple. Heavy lines have relayed out with barely the notice of the dispatchers. However, there has been and can be a complete breaking up of the whole pool with serious unstable conditions. Fortunately, such occurrences have been infrequent. There was a recent case of major transmission outage that did not cause breaking up of the pool, even to the surprise of the engineers who operate it. The Bonneville 220,000-volt lines feeding into the Tacoma-Seattle area went out due to a fault on an adjacent system while carrying a load of 200,000 kw. The pool functioned automatically and not only produced the 200,000 kw. dropped by Bonneville, but took 30,000 kw. of additional load from Bonneville that was being supplied through other interconnections.

An interconnection of this kind is like an immense flywheel with tremendous stored energy that is immediately given up if some sudden load is imposed that would tend to slow it down. The pool naturally did slow down some with such a jolt as the loss of 200,000 kw., but the dip in speed, or frequency, was of very short duration and amounted only to about one cycle out of the normal 60.

Significance

J. A. Krug, director of the Office of War Utilities, his staff and all the many capable engineers and operators of pool members are to be complimented upon the splendid job they have done. They deserve credit for the fine spirit of cooperation that has prevailed in the formation and successful operation of such a huge and complicated undertaking as this Northwest power pool. Their accomplishment has vital significance now and in the postwar era.

War has taught nations that man's most essential production tool is *power*. In the years to come the world will see a feverish race to place more and more power into the hands of the worker. Coal and oil will be utilized with less reckless abandon after *this* war. With millions of horsepower of hydroelectric power still awaiting development in the Pacific Northwest, this region can become the nation's No. 1 heavy industry producing section, if conditions are conducive for capital to be put to work. To utilize the tremendous electric power resources of this potentially rich empire to greatest economic advantage, pooling of these resources must continue on indefinitely into the peacetime era.

Electronics at Work In Industry—IV

Fourth in a series on electronic tubes and circuits. An electronic motor control device providing stepless speed control, overload protection and full torque at all speeds for d-c motors is described

E. W. Morris
Westinghouse Electric & Mfg. Co.
Los Angeles

TORQUE characteristics of direct-current motors make them desirable variable-speed drives for many industrial applications, such as machine tools, pumps and conveyors. Direct-current motors for such drives have required the use of full capacity a-c - d-c motor-generator sets to provide the variable d-c voltage necessary for speed control. These are relatively costly installations, requiring considerable floor space when compared with a simple a-c motor. In many applications, however, the advantages of d-c motor drives from an operating or production standpoint have warranted the installation of variable-voltage motor-generator sets, resulting from a desire to extend the use of d-c motor drives.

It was natural that electronic tubes should be considered as a means of providing variable-voltage supply for d-c motors to supplant the m-g set. Research in electronics has resulted in the development of an electronic device which can be coordinated with design of the d-c motor to provide ideal speed-torque characteristics. This device takes the place of the m-g set in some applications, and provides variable voltage for the armature of the d-c motor, and either constant or variable voltage for the motor field, as may be required by the load. Motor-generator sets for variable-voltage supply have high short time overload capacity, but the electronic control has many other advantages, such as wide range of almost stepless control, close speed regulation, automatic acceleration, stable operation with full torque at low speeds and the minimum dimensions of a wall mounting cabinet.

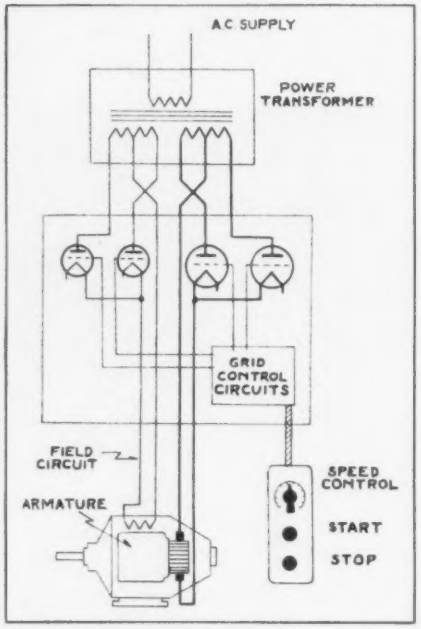


Fig. 1 (above)—A schematic diagram showing the component parts of newly developed electronic motor control

A simplified diagram of electronic motor control is shown in Fig. 1. Power from the a-c lines in a machine shop or factory is supplied to a separately mounted dry type transformer. The two secondaries of this transformer are connected to thyratron variable-voltage rectifiers, one of which supplies the armature and the other the field of the d-c motor. An advantage of this type of drive is that variable voltage now can be justified in smaller ratings than heretofore, which has led to the use of thyratron tubes for the rectifiers, to which power is supplied from either single-phase or polyphase lines. Ratings up to and including 10 hp. have been developed using thyratron tubes, but larger ratings using thyratrons and Ignitrons can be built as the occasion demands.

A control station is separately mounted and may be located near the operator or the driven machine. It includes start and stop push buttons, and a small potentiometer for speed control. If the application calls for re-

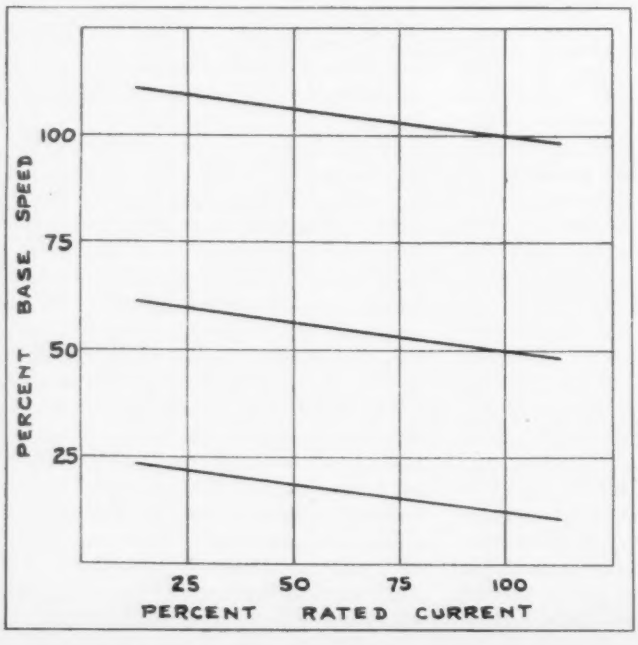
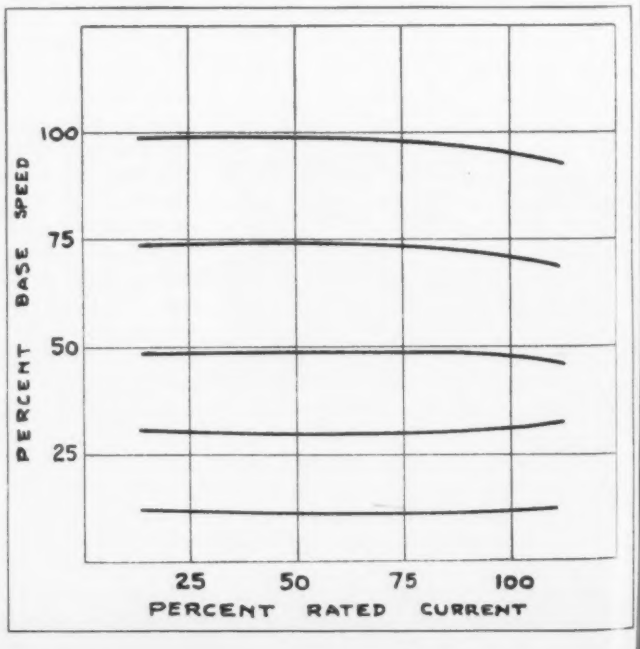
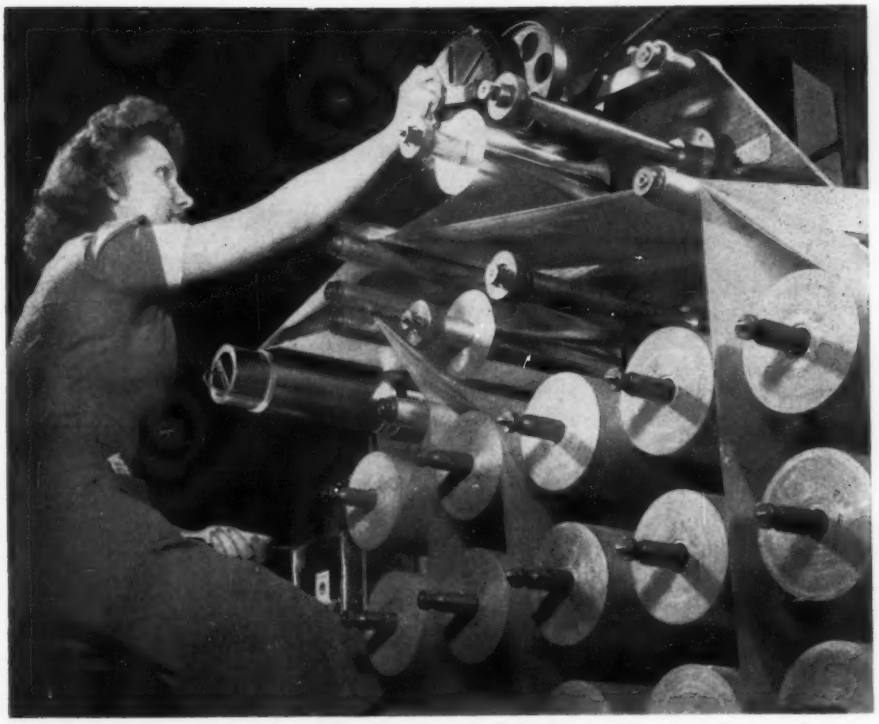


Fig. 2 (left)—Speed-torque curves for shunt-wound motor supplied with d-c from a motor-generator set. Fig. 3 (right)—Speed-torque curves for shunt-wound motor supplied with d-c from a compensated electronic motor control



Electronic speed control for d-c motors has increased production in many operations, such as winding capacitors from critical metal foil. Rectified d-c voltage from a-c supply line may be varied from zero to full motor rating or above by shifting phase of the a-c grid supply on the thyratron tubes used



versing, an additional push button may be added to the control station, as well as another potentiometer for speed control if the reversing speed differs from the forward speed.

Control can be obtained over a range of 5% or less to 100% of motor base or normal speed by armature voltage control only, while speeds above motor base speed may be obtained by field weakening.

Standard shunt-wound motors have typical speed-torque characteristics as shown in Fig. 2, the curves being obtained with three different values of armature voltage and with constant voltage applied to the field. The drop in speed from no load to full load is the result of a drop in armature voltage due to resistance of the armature winding. With electronic control, it is possible to compensate for this armature voltage drop and produce typical speed-torque characteritsics as indicated in Fig. 3. This compensation may be varied by an adjustable potentiometer located within the control cabinet. Thus the speed-torque characteristics of the motor and electronic control can be regulated to give a flat, a drooping or a rising characteristic for all speeds in the operating range.

It would appear simple to control the speed of a d-c motor merely by controlling the firing angle (point on the a-c wave) of thyratrons in the a-c supply circuit. Actually it is more complicated than is apparent, since motor speed depends both on the armature resistance voltage drop and the average value of voltage across the armature, which is not constant from the rectifier voltage supply. This makes it essential to have the compensating circuit in the electronic control, which results in an extremely well regulated and versatile drive for d-c motors from an a-c supply.

Control of speed is only one of the important functions performed by a modern electronic d-c motor drive. Other important functions include control of acceleration, reversal, and automatic protection against overload.

Protection against excessive load is afforded by a current limiting circuit, regulated by current flowing in the armature circuit. This protective circuit provides a delaying action in the firing angle of the thyratron rectifiers in the armature circuit, thus limiting the motor current during starting, reversals or in case of overload on the motor. This overload protective circuit can be preset and will operate over the entire load range. Rapid reversal of a motor properly protected with such a circuit will not result in any overload that will be injurious to the motor or the electronic rectifier tubes.

Automatically controlled acceleration is accomplished with the current limit acceleration described above, combined with an adjustable electronic time delay circuit. These two are combined in the proper ratio, depending upon the rate of acceleration desired.

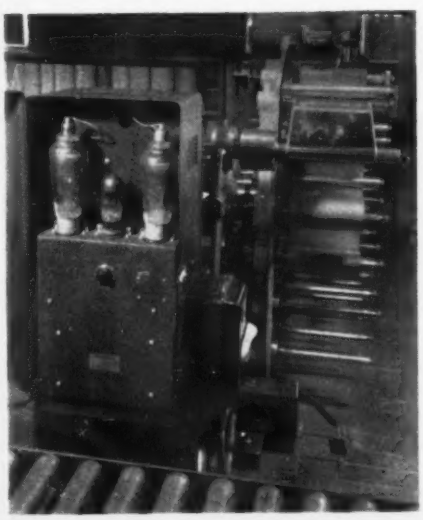
In those installations where the speed control is set for the motor to operate above base speed with weakened field, protection likewise is afforded. The control is so arranged that the motor always is started with full field. The field speed control does not become effective, nor is the field weakened, until the motor reaches base speed under armature voltage control.

Reversal and dynamic braking are accomplished by magnetic contactors in the armature circuit. Due to the protection afforded by the current limit circuit, the delay on the reversing and dynamic braking contactors is reduced.

With this type of electronic motor control, constant torque can be applied to the load from minimum speed up to base motor speed, which may cover a speed range of 20 to 1. Above base speeds the drive provides smooth acceleration at constant horsepower, which may increase the speed range by as much as 3 or 4 to 1. It is suited to many types of drives, such as: Lathes, grinders, milling machines, key seaters and gear cutters; tubing machines in rubber mills; conveyors and feeders in material handling industry; fans and blowers; cutters, slitters, winders, reels, and roll drives in the paper industry.

Electronic motor control promises to be extended to many other and larger applications, in which Ignitron tubes will provide armature voltage for motors of higher horsepower rating than now can be supplied from motor controls using the hot cathode thyratron.

A "soft" start for threading the delicate foil used in capacitors is obtained by means of the foot-operated solenoid (right foreground). After foil and paper are started and the tension is evenly distributed over the entire width of material the electronic control brings the motor up to full speed by stepless acceleration without breaking the foil. Hand winding displaced required 24 operators for same work



"Approved by Underwriters"—in the West

In celebrating its 50th anniversary, Underwriters reports to the industry on its job done, its war work, its Western laboratory

A LABEL, a name and a vague idea of what both mean may be all that most people in the electrical industry know of Underwriters' Laboratories, Inc. Few realize in how many ways this non-profit testing organization affects their lives and well being.

They may have a well grounded faith in it without quite knowing why. A bracelet on lamp cord with "Underwriters" on it gives a sense of value and safety in the use of that cord. A label on a switch, panel, piece of conduit or wire means a certain assurance of reasonable quality to the wireman, contractor, inspector or engineer. But to what these assurances are due is not often known or thought about.

It is appropriate this year to know why, for 1944 is the year in which Underwriters' Laboratories celebrates the completion of its first fifty years of service.

The Laboratories have come a long way in their ability to serve their clients, their sponsors, and the public since the start half a century ago in a small room "over the horses" of Fire Patrol Station No. 1 on Monroe Street, Chicago, where the staff consisted of one engineer, an assistant and a clerk, and their laboratory equipment was a bench, a table, a few chairs, and $350 worth of electrical equipment.

Like many other developments which have grown to importance in the last five decades, Underwriters' Laboratories was an outgrowth of the first Chicago World's Fair, the Columbian Exposition of 1893. A feature of the fair was to be a lavish display of incandescent bulb lighting in and on the buildings. This type of lighting was then new, having only recently come out of Edison's laboratory. During the period of construction a number of fires occurred in the fairground buildings. Some of these were caused by the "new-fangled" lighting. Apprehensive that this new lighting method might prove hazardous, insurance interests in Boston sent an engineer to Chicago to investigate the situation. That engineer was William Henry Merrill, founder-president of Underwriters' Laboratories.

Riding behind the horses at each call to the fairgrounds, Merrill's job was to determine what piece of electrical equipment, if any, had caused the fire, and why. This work and the reports which were written attracted considerable attention in manufacturing and insurance circles, not only in Chicago, but throughout the Central West and beyond.

Herbert G. Ufer, Western superintendent of Underwriters' Laboratories, Inc.

In this period before 1894, the insurance industry was also sponsoring the investigation of automatic sprinklers in the Chicago area by William C. Robinson. The two men soon joined forces to consolidate their laboratory equipment and expand their activities, Robinson shortly thereafter becoming the first chief engineer and vice-president of the new organization.

About this time the United States began to see the birth of many new industries. The new enterprise became closely associated with this industrial growth, finding opportunities for service in many new fields.

The tale is told how one day Merrill was sitting in at a poker game with the boys of Fire Patrol Station No. 1 when the signal for the station came in on the automatic alarm system. No one seemed to notice it. The game continued. The alarm was repeated, and a moment later the signal sounded the third time. Merrill turned to the Chief. "Isn't that your call?" he asked. "Yes," replied the Chief, "but we don't answer that. It's on the automatic system and even the horses know it's a false alarm and won't come out of the stalls." This incident is credited with having started the engineers on an investigation of the faults and failures then existing in automatic fire alarm systems.

The work was gradually expanded and soon the laboratory with its meager testing equipment and hand-made apparatus became cluttered with acetylene generators, spark arresters, gasoline and kerosene lamps, electrical wiring devices, and arc-lighting equipment. Whether the blowing of one or more acetylene generators through the roof had anything to do with it is not clear, but it is known that some of the overflow of these devices waiting for test was moved to other buildings where additional space was obtained.

While this work was going on in Chicago similar investigations were being conducted by a few individuals in other cities. The results of these separate investigations often did not agree. Embarrassment and some confusion resulted. To rectify this situation the idea was suggested to the National Board of Fire Underwriters that the Chicago laboratory be made the official testing station of the capital stock fire insurance business. In 1894 this was done and Underwriters' Laboratories, Inc. was thus founded.

In the fifty years which have elapsed since its origin, the objectives of Underwriters' Laboratories or its reason for being, have remained the same—to reduce the dangers to life and pro

UNDERWRITERS' LABORATORIES, Inc.

Staff and Representatives in the 11 Western States

STAFF

H. G. Ufer, western superintendent . . . . . Los Angeles
H. G. Dodge, senior engineer . . . . . San Francisco office
R. J. Larrabee, field engineer . . . Seattle
F. D. Weber, engineer . . . . . Portland

Representatives

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C. R. Meikel . . . . . Bakersfield
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John L. Noble . . . . . Vancouver, B. C.
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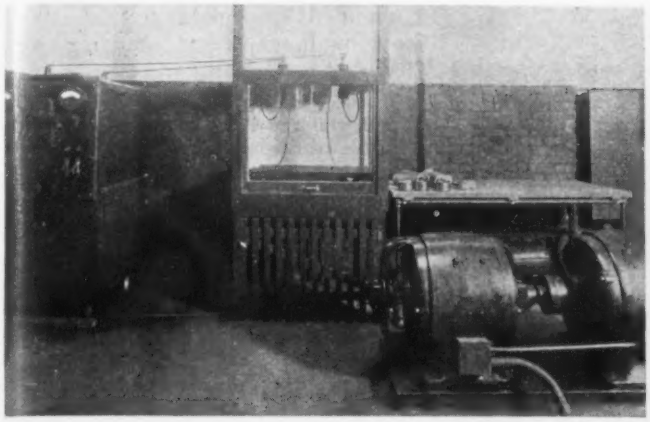
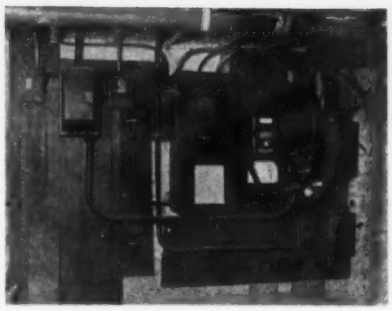


Above, views of the original laboratory at 615 Commercial St. in San Francisco. Left, the original switchboard.

erty by science and engineering. "Know by Test," an admonition of its founders, is the principle underlying Underwriters' Laboratories' activities. From the very beginning it was recognized that "looking at a device" or visual inspection of the constructional features of a product were not enough.

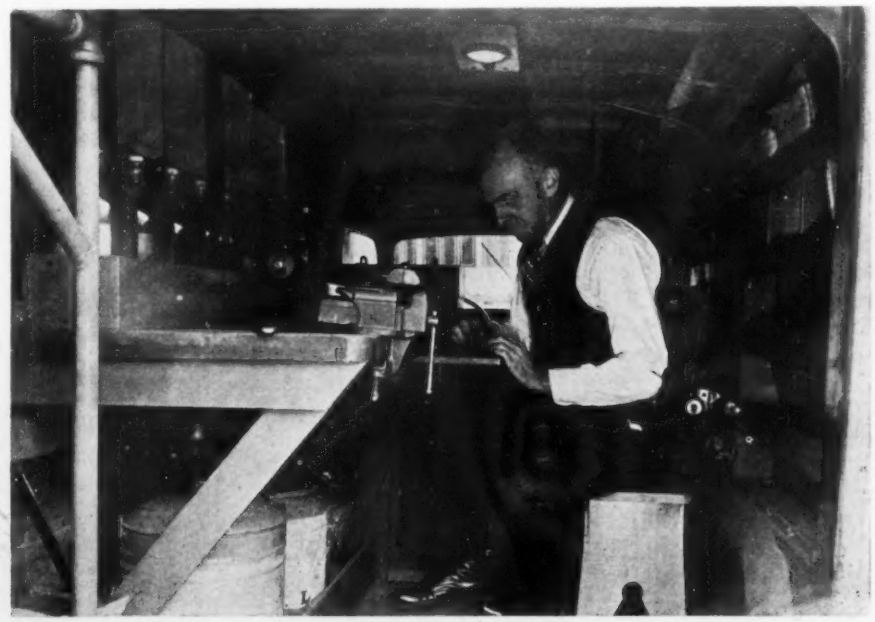
Fire, the original consideration, is still the principal one of the Laboratories today. *Ignis Servus Non Dominus*, the old slogan, as aptly describes one objective of the organization as it ever did. Freely translated, it means: "Keep fire a servant, don't let it become man's master." The prevention of other hazards, however, is also included in the scope of activities. Accidents, electric shocks, explosions, burglaries, and related dangers receive careful consideration. The variety of work carried on today is vastly greater than was ever dreamed of in the early days. Once the engineers were "jacks-of-all-trades"; today, they are specialists in either the protection, hydraulic, gases and oils, chemical, electrical, casualty and automotive, or burglary protection departments.

All of these departments are represented at the main testing station in Chicago where there are seventeen de-



partmental laboratories equipped with much unusual and unique test apparatus as well as with standard testing equipment. Much of the special equipment in these laboratories is designed by the engineers and some of it is constructed in the Laboratories' shops.

Some years elapsed before Underwriters' Laboratories, Inc. was represented on the Pacific Coast by other than part-time employees of local rating bureaus located in Los Angeles, San Francisco, Portland and Seattle. Shortly after the National Board of Fire Underwriters established an office in San Francisco in 1921, W. H. Merrill, president of Underwriters' Laboratories, Inc., appointed C. H. Lum of the National Board of Fire Underwriters as agent for the Laboratories in San Francisco and authorized him to secure the services of a full-time employee to represent Underwriters' Laboratories, Inc. The original laboratory, established several months later, was located in the upper story of a building at 615 Commercial St. and the initial equipment was very meager indeed. There were a few small hand tools, taken from an automobile tool kit, and a work bench consisting of two planks supported by packing cases. The testing equipment consisted of a 600-amp., 125-250-volt, d-c supply, a 100-amp., 110-220-volt, single-phase a-c supply, two second-hand resistors purchased from the Market Street Railway Co., several ammeters and voltmeters sent from the Chicago office, and a number of thermometers. As equipment was added much was improvised and in many cases was constructed of odds and ends which were



Ray Larrabee, field engineer, used to tour the West in the traveling laboratory, buying on the market samples of cords, fuses, devices; making tests of them to check whether standards were being maintained. The first traveling lab was in a truck; later a trailer was necessary to carry field test equipment

made to serve the purpose. The products actually submitted for tests during the first few years consisted mainly of enclosed switches, cabinets and cutout boxes, panelboards and electric heating appliances.

Subsequently, an elevator interlock testing machine was set up due to the recognition of such equipment on the Pacific Coast. This machine was quite bulky and during operation the entire building fairly shook. It is quite possible this eventually led to the tenants in the first floor looking for another site for their business as they moved shortly afterward and the Laboratories expanded their lease to cover the first floor of the building. Here it might be mentioned that the first floor tenants had been manufacturers of Chinese perfume and strange odors very often found their way into the laboratory.

Gradually additional testing facilities were added. Service capacities were increased, a direct-current motor-generator set was installed, a specially designed enclosed switching testing machine was designed and built, high-voltage transformers for conducting dielectric strength tests were provided and additional meters were obtained.

As the work of Underwriters' Laboratories, Inc. became better known and as the production of radio receivers developed on the Pacific Coast it became necessary to increase the engineering staff, and by 1937 a total of five engineers was employed. During the latter part of this same year it became evident that the physical facilities were rapidly becoming inadequate and the Laboratories were moved to more spacious quarters at 500 Sansome St. Here both the laboratory and office facilities were greatly expanded. A specially designed switchboard provided with 400-amp., 120-208-volt a-c and 400-amp., 125-250-volt d-c services was installed. Autotransformers were installed in conjunction with the alternating-current service so that the necessary flexibility of operation could be obtained. In conducting tests of small horsepower rated

Howard G. Dodge, senior engineer, San Francisco laboratory, at dielectric strength testing booth, making a test

devices, the need for synthetic loads capable of being readily adjusted to provide various power factors at standardized test voltages was apparent. Therefore, three such variable loads were provided. Each unit consists of a tapped air core reactor and tapped resistors housed in a cabinet which is mounted on rollers for portable use. The equipment may be used for three-phase tests by interconnecting three of the units.

More recent additions to the laboratory include standardized rain test equipment for testing enclosed switches, cabinets, etc., intended for use outdoors, vacuum tube volt-meters, portable autotransformers for adjusting line voltages to agree with ratings on submitted equipment and a cathode ray oscilloscope for studying wave forms.

In 1941 the staff of the San Francisco office was expanded still further by the addition of an engineer to take over the testing of oil burners and related equipment as the growth of these industries on the Pacific Coast had progressed sufficiently to justify such a move. Previous to that time such equipment was sent to the Chicago office for test and the transfer of this work to the Pacific Coast has greatly facilitated this type of testing.

Three hundred seventy-five thousand products have been approved by Underwriters' Laboratories, Inc. to date and are listed in its booklets of tested and inspected items. The 5,000 manufacturers of these devices, materials, and systems produce in a normal year, in their more than 5,500 factories, half a billion of these safeguarded articles.

This outpouring of safer articles for industry, business, and the home has increased in volume year by year throughout the 50-year period. The variety and number of these products in use in buildings of all kinds, transportation systems, and elsewhere is so great that virtually every man, woman and child in the United States and Canada comes in contact with many of them every day and relies on them for safety, regardless of who he is, where he goes, or what he does.

Two things, aside from the variety of products investigated, make Underwriters' Laboratories a unique organization. The first is its inspection service.

A corps of technically trained men carries out the inspection service, operating from 185 centers of production in the United States, Canada, London, England, Honolulu and Hilo, Hawaii, and making, in recent years, upwards of 85,000 annual visits at factories.

All of the products which are investigated and pass the tests at one of the testing stations are periodically inspected at the factories. Frequency of

Main switchboard at the laboratory at 500 Sansome St., San Francisco, with full testing facilities, at left. At right, the radio testing bench with 180-cycle a-c supply and test panels. At the rear, neon tubes for testing sign transformers under load

inspection depends on the production schedule and the type of device, but in each case continued compliance with the requirements of the safety standards is attained. Inspections are made as long as the product remains on the Laboratories' lists of tested and inspected products. These investigations involve the examination of the raw materials of which the article is made, inspection of partially completed products on the production line, and tests of representative samples of the finished product selected at random.

"Underwriters' Laboratories, Inc. Inspected" labels are issued by inspectors for use on products passing this factory investigation. Most of these labels are serially numbered.

As it is not feasible to place a label on all types of products investigated, all approved products are listed by manufacturer's name, catalogue number, and with other pertinent information, in booklets published by Underwriters' Laboratories. Four such booklets are issued annually covering fire protection; gas, oil and miscellaneous equipment; electrical; and a single book combining accident hazard, automotive, and burglary protection equipment. Supplements to the first two lists are issued semi-annually. The electrical list is brought up to date monthly. Two hundred thousand copies of these publications were distributed free of charge in 1943 to federal, state and city authorities, industry, the armed services, inspectors, insurance people, purchasing agents, and other interested persons.

The second thing that makes Underwriters' Laboratories a rather unique organization is the fact that it is not a profit-making company. The work of compiling safety standards, testing, inspecting at factories, labeling, conducting research, and publishing the results of these activities is carried on as a service to the public. "For Service, Not Profit," Underwriters' Laboratories' motto, is more than a slogan, it is an actuality. From 1913 to 1943 $1,400,000, the income over operating expenses has been returned by the Laboratories on a prorata basis. In 1943 $243,000 was returned. The enthusiastic support of its capital stock insurance sponsors, of its manufacturer-clients, and of the public have made this non-profit operation possible.

In the early days of the organization, and until 1917, contributions from the capital stock insurance business helped the Laboratories grow. Beginning with the first $350 appropriation for the equipment of the initial laboratory in Chicago, the National Board of Fire Underwriters and the Western Union (an insurance organization, not the telegraph company), appropriated over the twenty-three year period $276,000 for buildings, equipment, and operation. The maximum contribution in any one year was $20,000. While these appropriations were exceedingly helpful, in no instance were they sufficient to cover entire operating costs.

H. E. Baker, of the San Francisco laboratory staff, testing Western made electrical equipment — outlet boxes and enclosures at left, fuse and circuit panels at the right

Since 1917 Underwriters' Laboratories has been entirely self-supporting. The cost of operation is borne by individual manufacturers who make use of its facilities. It is not a membership organization. Each unit of work is charged to the manufacturer on a cost basis. The time of an engineer assigned an investigation, construction work done, materials used, preparation of the report and any other element entering into the cost of performing the work are totaled upon completion of the job by means of an elaborate cost accounting system. From these charges Underwriters' Laboratories receives its support.

During the past two and one-half or three years the regular functions of the Laboratories have been expanded to include much special war work. A few typical problems have been (1) Fire and explosion hazards of Butadiene and Styrene used in the manufacture of Buna rubber. (2) Investigation of the effectiveness of electrically conductive flooring, conductible floor finishes, and conductive shoes for use in arsenals and munition plants (and hospital operating rooms) where accumulations of static electricity are a hazard. (3) Temperature tests of dust-tight lighting fixtures and tests of other hazardous locations using electrical products. (4) Determination of flammability of camouflage materials for gun emplacements, and for other protective concealments. (5) Inspection of the lightning protection installed for the protection of shell-loading and munitions plants. (6) Inspection of protective installations for safes and vaults for storage of securities, narcotics, medical supplies, secret codes, valuable documents, etc.

Special tests and inspections of war materials have been arranged, military classes have been sent to both the Chicago and San Francisco testing stations for actual demonstrations in fire prevention and related subjects. The Laboratories has sent its experts to serve with government branches, has maintained a consulting service for the military, for industry, and for persons concerned with maintaining production through safety.

Looking back at the record and accomplishments of the first fifty years, a statement, written early in the history of this organization by a man who had much to do with developing the laboratory idea into a reality, seems appropriate now to express the sentiment of those who look forward with confidence and satisfaction to the second fifty years of service.

"We are proud of our plant and very proud of the work we are doing, because, far beyond any particular interest of the underwriter which we may be serving, we are doing something for manufacturers and buyers and users and property owners everywhere—we are doing something for humanity. And our greatest asset is not our people nor our plant nor any tangible thing that can be expressed in figures—it is our good will. Against more or less natural prejudice, against selfish interest, against some misrepresentation and a little competition, we have established a good name for our institution and its work which will make for our success just so long as it is maintained. Should we ever lose it nothing of any kind can supplant it: there will be little left of our structure but the mere tools of our trade—some buildings and machinery which represent only dollars and cents. And so with our boasting of past achievements we strive to keep a watchful eye on the morrow, that Underwriters' Laboratories may continue to occupy its unique position—the only successful thing of its kind in the world."

EMEA *Dope Sheet*

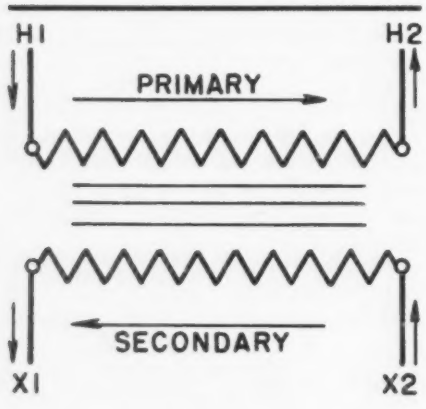
Phase Relation of Transformers

Primary winding vs. secondary winding, hooked up single-phase and three-phase star to delta, delta to star, star to star and delta to delta

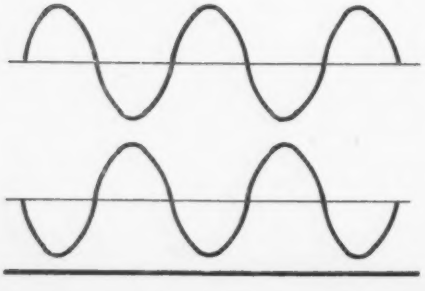
Roy Burnett
Electrical Engineering Dept.
Lockheed Aircraft Co.

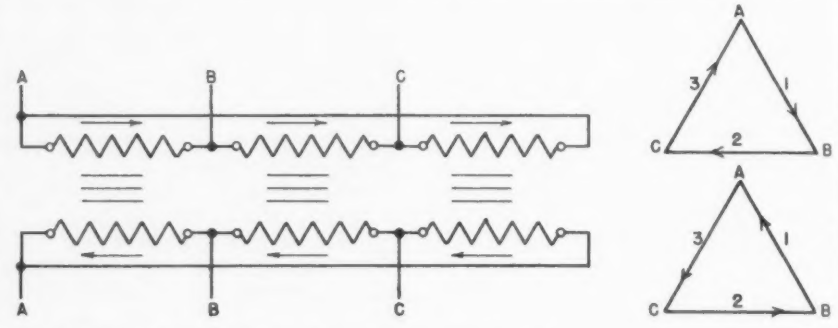
PURPOSE of this article is to demonstrate what takes place in a bank of transformers, hooked up according to the various standards. The cause of confusion in a man's mind regarding phase shift in a bank of transformers, is that he is thinking of the phase shift taking place within each transformer. To clear up this confusion, remember that the purpose of the iron core in the transformer is to couple inductively the primary winding to the secondary winding so there can be no power applied to one winding without inducing the same amount of power in the other winding.

The next important step is to emphasize the time element; in other

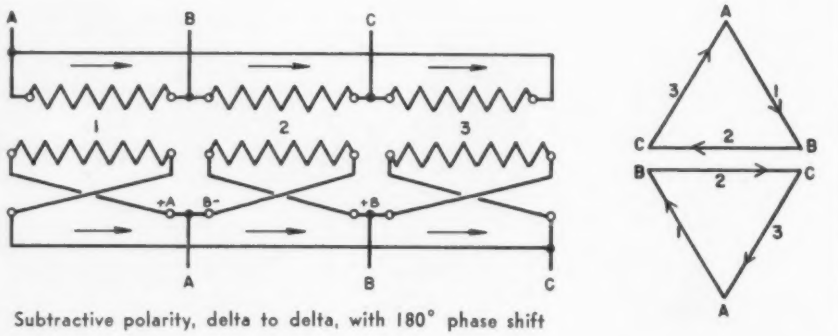


Additive polarity

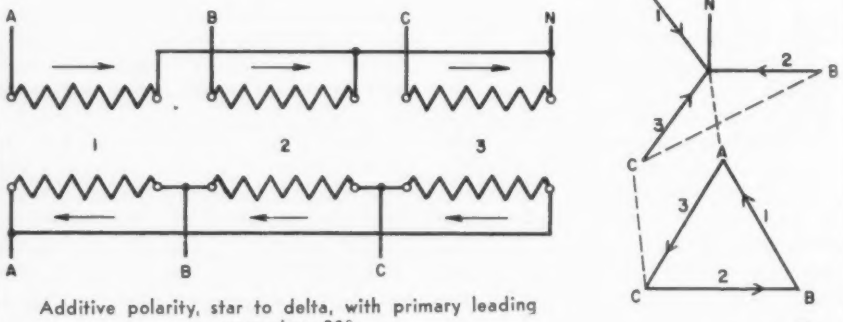




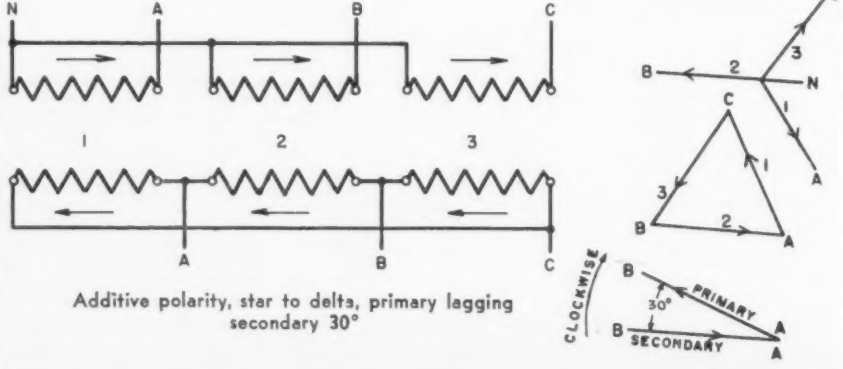
Additive polarity, delta to delta, with no phase shift



Subtractive polarity, delta to delta, with 180° phase shift



Additive polarity, star to delta, with primary leading secondary 30°



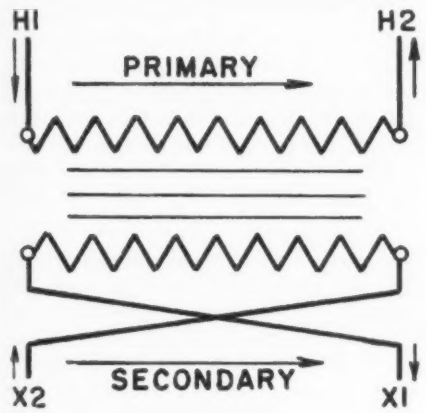
Additive polarity, star to delta, primary lagging secondary 30°

words two things happening at exactly the same time or two things, each happening at different times.

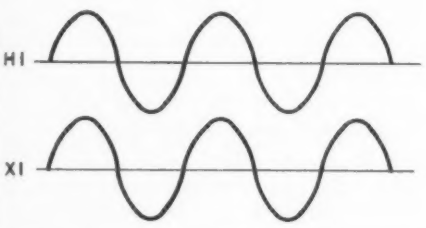
To bear out the statement previously made that the phase shift does not take place within a single transformer, look into a single phase transformer.

Apply a potential on H_1 and H_2 there will be an induced voltage across X_1 and X_2 in the opposite direction, if the two windings are wound in the same direction. This is known as *additive* polarity. In other words, if H_2 and X_2 are tied together, measure the voltage across H_1 and X_1 and you read the voltage of the primary plus the voltage of the secondary.

The diagram below shows a *subtractive* polarity hook-up; in other words if H_2 and X_1 are tied together, measuring the voltage across H_1 and X_2, the ultimate would be the greater voltage, less the lesser voltage.

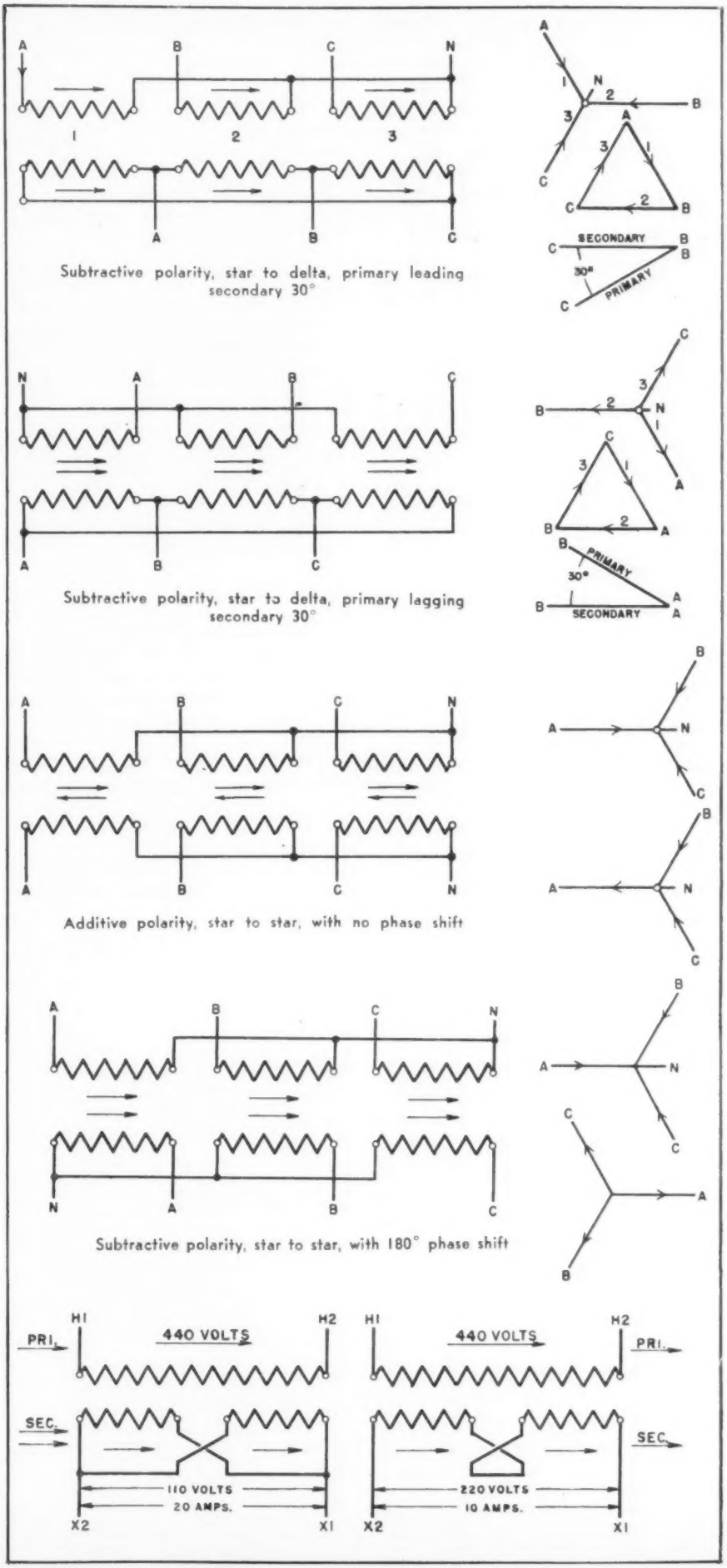


Subtractive polarity



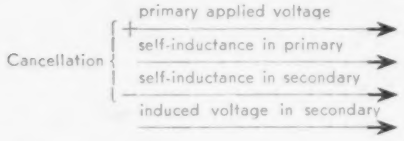
Next, review one of the laws of inductance, which tells that if two conductors are placed in proximity to each other and in parallel, with no metallic connection between them, and an alternating voltage is applied to the ends of one conductor, an alternating voltage of the same frequency will be induced in the second conductor, but in the opposite direction, or 180° out of phase.

In the primary winding of a trans-



Single phase transformer, showing diagram of hook-up for one-half voltage, and twice the current, and hook-up for twice the voltage and half the current; bottom diagram at right

former, the current is very low when there is no load connected across the secondary, because the counter electromotive force induced into the primary winding by what is known as self-inductance, or reactance, is 180° out of phase, or is in the opposite direction of the applied voltage. If a load is connected across the secondary winding, a current will start to flow, but will flow in the opposite direction to the primary current. The secondary current also induces a back pressure, or counter electromotive force, which is 180° out of phase with the voltage induced by the primary current. The diagram below will show that the current in the secondary tends to cancel out self-inductance in the primary,



and the primary current tends to cancel out self-inductance in the secondary winding, which in turn shows that primary current varies as the load varies across the secondary winding.

Step by step, it has been shown that the only phase shift that takes place in a single transformer is the 180°, or reverse action of secondary to primary, which is the same thing as exchanging two wires of any simple two wire circuit, and which can be corrected by exchanging back again. So, the difference between an additive polarity transformer and a subtractive polarity transformer depends on which way the leads are brought out of the transformer case.

The type of phase shift next considered is not so simple as the type just covered. First it will be necessary to show the three-phase hook-up with no phase shifts, then show three-phase hook-ups with phase shift. Direction of rotation must be assumed, bearing in mind that each phase goes through 360 electrical degrees every cycle. So, for an arbitrary direction, assume a clockwise rotation.

After analyzing the different standard hook-ups, let us discern what is meant by phase shift; when and where it takes place. Look at the first star to delta hook-up diagram again and note that the star is hooked to a four-wire circuit, while the delta is hooked to a three-wire circuit.

Note again the primary of transformer No. 2 is connected from line B to neutral, which is in phase with the secondary of transformer No. 2, which is connected to lines B and C. Therefore, the peak voltage between lines B and C occurs at the same time the primary voltage peaks between primary line B and neutral; not when the primary voltage is peaked between primary lines B and C.

Then the phase shift is the result of two things happening at different times, or the voltage of the primary through two transformers peaking, either 30° ahead or 30° behind the secondary peak voltage, which is across only one transformer.

The three-phase star connection is used where there is a demand for three single-phase loads of different values, or an unbalanced three-phase load. The neutral conductor will carry the unbalanced current brought about by connected loads of different values across the different phases. The three-phase delta hook-up is best suited for a balanced three-phase load.

Priorities

Civilian requirements get serious consideration

CIVILIAN requirements in appliances, fans and lighting were given some serious consideration during the past month or two by the meetings of the household electrical appliance distributors industry, domestic electric range industry, the domestic and commercial fan industry, and the fluorescent lighting fixture industry advisory committees in meetings with government officials of the War Production Board and Office of Civilian Requirements. So were the methods of distributing the manufacture and later the output which may be authorized.

● *Irons* are on the list to be manufactured. Generally speaking, they will be made by former manufacturers of irons. One automatic and one non-automatic model will be permitted, nickle plated. Of interest to dealers is that no turn-in will be required but customers will be asked to certify their need for a new iron to the dealer. Allocations of available supply of irons is to be on basis of former number of dealers a distributor had, adjusted for those gone out of business and for increases in population in war areas. Rules against discrimination by distributors were prescribed and an appeal board set up for dealers.

● *Refrigerators* are not likely to be made this year at all. There is still some stockpile for essential needs. No decision was reached whether any low-temperature freezers would be made for farm use or not.

● *Washing Machines*, if any at all, will be very limited in number in 1944.

● *Repair parts*, except motors and controls, should be available in necessary quantity.

● *Fans*, it was requested of WPB should be made to supply urgent industrial and commercial requirements, 100,000 "shore use" fans. There may be 25,000 12-in. and 75,000 16-in. fans authorized.

● *Ranges* will be permitted to be manufactured in the third and fourth quarters of 1944 at the rate of 22,000 per quarter, 5,000 of which will be for military requirements.

● *Fluorescent* lighting fixture manufacture will not be relaxed because of a continuing shortage of small transformers, all of which are needed for military equipment. But fluorescent lamps are available in sufficient quantity to take care of replacements and for such new fixtures as are made for priority users. But rapid large-scale increase in lamp production would run into shortages of certain fluorescent powders. WPB is studying the effect of substitutions in fixtures, many of which have proved very inferior.

● *Freon gas* has been one reason, along with motors, for denial of refrigeration production. New facilities for producing Freon will come into production in April and in September and relieve a shortage, but essential demands will still come first and little or none be available for civilian uses.

● *Fuses and wiring devices* should be sold to retail customers without any priority rating, WPB's wholesale and retail trades division has ruled. Dealers may or may not use CMP 9-A to obtain supplies of these items.

● *Fuse tubing* cannot be vulcanized fibre any more in the non-renewable types. The Navy needs all this tubing. Paper tubing can be used instead. Fuses rated 250 to 600 volts or more are exempted.

● *Prices* on outlet boxes and wire took some adjustments on the West Coast during the month, bringing them up to full ceiling level. Formerly competition of some manufacturers, frozen at a lower level, had brought many prices down to those levels. Now they are touching the Oct. 1, 1941 ceiling. Wire prices rose because Buna S synthetic rubber insulation instead of crude or reclaimed rubber is being used exclusively and application for increases has been made with OPA. Apparently some have received approval.

● *Irrigation pump line extensions*, for pumps having 25 gal. per min. minimum, whose total extension cost must not exceed $1,500, will now be permitted under supplementary order U-1-i.

● *Steam turbines* authorized built by OWU include one of 625-kw. for City of Gunnison, Colo. municipal system.

LIGHT for V-MAIL

The Need

Illumination for general operations in sorting, shipping and receiving in the V-Mail department.

Conditions

Prior to relighting, the area was lighted to 4 foot-candles by means of inside frost lamps in RLM shallow-bowl reflectors.

Installed

Continued rows of two-lamp, 48-in., 40-watt, RLM wartime industrial fixtures with white F lamps; a total of 235 lamps.

Results

Average intensity 45 f-c in sorting room, 20 f-c in receiving and shipping departments. "Where 10 bad throws had occurred before, there is now an average of only two bad throws."

Who

"Fleet Post Office" for U. S. Navy, San Francisco. Layout designed by Pacific Gas and Electric Co. lighting staff, San Francisco division. Installation by Victor Lemoge, electrical contractor.

Conditions

Prior to relighting, 10 to 12 f-c from glass enclosed units and some indirect units. There was glare from the enclosing globes, as well as sharp shadows. The indirect units through neglect were dirty and had a reduced reflection factor. Ceilings were dark.

Installed

A row in each bay of 200-watt, URC type Mitchell units, with fluorescent lamps, a total of 46 units. Ceiling repainted.

Results

At desk level, 48 to 52 f-c, free of glare and with shadows eliminated. Increased visual efficiency in the accounting department greatly appreciated.

LIGHT for an OFFICE

Who

Fairbanks Morse Co., 630 Third St., San Francisco. Layout designed by G. A. Trosper, Pacific Gas and Electric Co. Installation by Buzzell Electric Works, San Francisco.

The Need

Modern lighting for accounting and general office work.

Some Aspects of Postwar Rural Life

An appraisal of rural electrification opportunities existing after the war, including an estimate of the increase in number of California farms

*H. B. Walker**

Professor of Agricultural Engineering, University of California

ELECTRIFICATION of our farms and homes has been of inestimable value to us here on the West Coast in meeting our wartime responsibilities. The war mandate to produce more with less of labor and equipment, hopeless as it has seemed at times, has come to pass because of the integrity of the equipment on, and the services to, our farms and in our homes.

It is hard to conceive how California farmers thus far could have met, or will meet, the production challenges of a nation at war, without the half million electric motors on our farms and in our farm homes, with their ever ready standby energy, totaling around one and one-quarter millions of horsepower. Women in these homes, many of them, have toiled in the fields and still have been able to supply the family with wholesome, palatable food, because 75% of all farm homes have electric refrigerators.

Our great reliance upon electric power and service on our farms—a great bulwark in the maintenance of the morale and productive capacity of farm folks—has not been entirely free of worry. Maintenance agencies are depleted of both materials and manpower, and it has required near superhuman effort, as well as extreme ingenuity and patience, to keep equipment in service. If it had not been for the inherent reliability which has been built into our farm and home electrical equipment, we could hardly have got by. Surveys recently made of required services on farm electric motors during the first year of the war, indicated that only 5% required replacement, or repair, of brushes; only 1.4% had bearing troubles; another 1.4% had to be rewound, and motor replacements amounted to only one-half of one per cent. These repairs seem insignificant when compared with the 10% or more of overhaul jobs needed each year on our farm tractors, trucks and automobiles. Surely our farm electrical equipment has become as faithful an ally in war, as it has been in the past a faithful servant in peace.

The war has brought to California a million new people. No doubt a majority of these will wish to remain here if suitable employment conditions prevail. Some will return to their original homes. Rural populations in California have declined under the impact of war, and the attendant industrial expansion. This loss should be re-established promptly with the cessation of hostilities and we may quite reasonably anticipate a continuing demand for our agricultural products due to the following reasons:

1. Food is recognized as an important factor in establishing and keeping the peace.
2. There will be no industrial transition period for agriculture with the close of the war. Its plant, even though it requires some rehabilitation, will continue to operate much the same as during the war.
3. Reclamation projects now in existence will be prepared to release needed irrigation water into water-deficit farming areas, as well as for the development of limited areas of new land.
4. Veteran rehabilitation always includes agriculture.
5. A larger total population in the state will support a larger agricultural hinterland.
6. Although the war period has developed certain restrictions in food supplies, on the whole it has tended to build up an appreciation of the value of protective foods, thus enlarging domestic markets for the types of farm products we produce in California.
7. Agriculture in California is of growing importance in both complementary and supplementary relationships to the state's industrial growth.

Time will not permit a discussion of all of these points in detail, but perhaps a brief discussion of the over-all picture may develop some points of direct interest to those concerned with rural electrification.

We have in the United States, at present, something over six million farms of all types and sizes, which are operated under a wide range of efficiencies, when measured in terms of ratios of labor energy input to units of production output. For example, in California it requires today about one man-hour of labor to grow and harvest nine to ten bushels of wheat, while in West Virginia, under different production environments, it requires approximately one and one-quarter hours of man-labor to produce one bushel of wheat. Similar comparisons could be made throughout the United States, frequently to the advantage of California but not always. The important thing such data do not reveal is that in California for this particular crop, we have large mechanized farms as compared to smaller units in West Virginia. It has been roughly estimated that one-third of the farms of the Nation produce 85% of our marketable products, another one-third 13%, and the remaining one-third only 2%. Some federal groups have intimated that the close of the war will bring an expansion of 2,000,000 farms for the nation. Under the changed industrial and social environments caused by the close of the war, I am not inclined to question this expansion when measured in numerical terms. Undoubtedly, great numbers of families will seek rural environments for better living, after experiencing the congested, wartime, living conditions found in our metropolitan areas.

It does seem to me, however, that this growth as measured in number of farms, will not be reflected directly in like increases in productive capacity of our farms. Small farms do not have the opportunity to use labor and equipment as efficiently as large farms. For example, a recent study of farm power in California showed that tracklayer tractors on farms of 50 to 100 acres in size are used 1,070 hours per year, as compared to 1,550 hours per year for farms of 700 acres or larger. Similarly, wheel tractors on the smaller farms are used 830 hours per year compared to 1,115 hours per year for the larger farms. This study also showed that wheel tractors are used more frequently on small farms than on large farms with the opposite relationship for tracklayers. Since the average tracklayer has approximately double the drawbar horsepower of a wheel tractor, it is apparent that manpower efficiency in relation to power utilization is much greater for the larger farm. These comparisons do not take into account our really small farms for we have in California a total of approximately 133,000 farms, of which 86,000, or approximately 65%, are less than 50 acres in size, with 28% of the total in the bracket between 10 and 29 acres and nearly 24% of less than 10 acres.

Admitting there may be a great rural

*Extracts from an address before the CREA Sixteenth Annual Rural Electric Conference.

expansion in farm numbers, the fact remains that our larger farms will continue to be the chief suppliers of surplus products, particularly for out of state consumption. It must be assumed, I believe, that the greatest growth in farms will be in the smaller-sized brackets. This will be due to the following: (1) Veterans entering agriculture will be subsidized on a financial basis that will preclude large acreages; (2) industrial workers undertaking agriculture will not have capital or experience to undertake extensive operations, and (3) much of the expansion will be of a suburban nature, supplementary to industrial employment.

In this type of farm expansion, rural electrification can render an important service. True enough, the services to large farms will in no way be minimized, but there will be less expansion in numbers of new large farm installations, but relatively expansion of service in these will be for new uses. For smaller farms, where the number of new enterprises may be high, whole new installations of services will be necessary, including such equipment as refrigerators, washing machines, stoves, fans, quick freezing units, domestic water systems, small irrigation units, lawn mowers, drying equipment, incubators, brooders, small grinders, air conditioning units, sweepers, and various types of miscellaneous household and farm shop equipment.

A study recently made of motor uses with reference to farm sizes showed the same incidence of fractional motors on farms of 50 to 99 acres as for farms of 220 to 379 acres; but for motors of larger size the incidence was about 50% greater on the larger farms. This would tend to indicate that new farm installations in the postwar period will include considerable house wiring, household equipment, and small motor installations. This same study revealed that on the average an electrified farm has a connected motor load of 13.4 hp. Undoubtedly, the motor load for these potentially smaller farms will be less than this average, but surely these will average more than half of the general total average and could readily be built up to an average of 8 to 10 hp. even for farms under 20 acres in area.

A study of uses on 588 California farms ranging in size from 10 acres and upwards revealed 53 different uses for electric motors alone. This didn't take into account the various applications in farm shops or varying uses of portable motors. Undoubtedly, if all separate uses were included upwards of a hundred established electric motor uses could be found on our farms today and, moreover, motor applications to farming operations are not exhausted. The order of frequency of uses on these 588 typical California farms located in 35 separate counties was as follows: refrigerators 75%, irrigation pumps 69%, washing machines 65%, domestic pumps 64%, milking machines 26%, portable and miscellaneous motors 21%, shop motors 20%, mixers 15%, and in lesser percentages, sweepers, fans, incubators, milk coolers, food grinders, separators, house coolers, ironers, sewing machines, dehydrators, hullers, saws, compressors, elevators, furnaces, feed mixers, sump pumps, blowers, brooder fans, graders, lawn mowers, paint sprayers, shearing machines, feed choppers, sorting tables, centrifugals, cement mixers, oil pumps, bottlers, bottle washers, prune shakers, hedge clippers, sack cleaners, waxers, dishwashers, juicers, vacuum pumps, dippers, bean cleaners, sackers, milk pumps, churns and pasteurizers. There was a total of 2,586 motors used on these 588 farms, with a reported connected load of 7,863 hp. These data are not reported to impress you so much with what exists, but to indicate the vast potentialities of rural electrification in the postwar period. Surely we are far from use saturation on existing farms and new farms mean further electrical installations of existing applications.

If the nation should expand its farm numbers, how many of these are likely to be in California? At best this is a speculation, but following war, there has always been a back surge to the land. The large increase in the state's population, the difficulties in converting the state's wartime industries to peacetime production, veterans' rehabilitation programs, and the inherent tendency for a nerve-racked people to seek the "wide, open spaces," surely will operate toward a relatively large increase in small farms. This alone could readily account for a farm increase of 30% or more. However, the acreage involved and the surplus production involved from such expansion are not likely to be so impressive.

California, a great agricultural state, is, likewise, gaining in its industrial stature. For our state, agriculture is both supplementary and complementary to our industrial development. The favorable climatic conditions of this region are attractive to those who enjoy outdoor life. These constitute attractants to our supply of industrial workers. On the other hand, the short work week, which surely will come with the return of peacetime economy, provides an opportunity for these workers to enjoy outdoor life, and at the same time materially contribute to their income by owning small suburban farms. The success of victory gardens the past year has stimulated interest in side-line farming, and I should expect a considerable number of our new postwar farms to be of this subsistence type. In this way agriculture becomes supplementary to industrial development.

On the other hand, many of the crops we grow have industrial potentialities. Flax, for example, which is grown primarily as a source of oil, provides feed by-products, raw materials for paper, and it is an essential for our paint industries. Cotton, grown primarily for fiber, is equally valuable for oil, feed by-products, linters, etc. Sugar beets for sugar, a universal food product, is valuable for its by-products as cattle feed. It is now admitted that the field by-products of a normal sugar beet crop are equivalent in livestock feed to an acre of Iowa corn. Rice, which is grown primarily for its value as food, provides a material for paper manufacture, and recent methods of processing provide a rich source of desirable vitamins. Potatoes, grown for food, also provide a source of raw materials for starch as well as alcohol.

The war has made us conscious of the rapid depletion of our natural resources like oil, iron, copper, etc. California produces many crops which may be utilized for alcohol production, plastics, rubber, fibers, and other so-called chemurgic products. In these things California agriculture offers great potentialities. Naturally, low-cost raw products are essential to such industrial expansion. Mechanical equipment contributes not only to lower production costs but there are unexplored potentialities in rough, or primary on-the-farm, processing methods, which may be done to economically prepare agricultural products for industrial uses. Such processing might very well involve electricity in many ways and also provide labor markets for farm help during so-called off-season periods. In these ways agriculture becomes complementary to industrial development.

The American diet is not only of interest but it constitutes a responsibility of the American farmer. The percentage of total calories supplied for our diet by various food groups is as follows:

Livestock products	46%
Cereals	27%
Sugar	15%
Fruit and vegetables	6%
Potatoes	4%
Legumes and nuts	2%

It is not my purpose to discuss these, but the importance of livestock products is noticeable. Naturally, this state is known for its specialty crops and, due to our favorable production environments, it is not likely we shall

deviate very far from these crops to specialize extensively in livestock production. We do have an opportunity to expand our livestock industry through by-product utilization and the improvement of our facilities to produce and process forage. Dairy and beef animals get over 75% of their feed from forage and pasture crops — sheep get even more. The irrigated pasture is a great boon to California livestock production. Land which is not suited to specialty crops often is satisfactory for irrigated pastures. Here again is an opportunity for rural electrification, through irrigation pump installations, feed chopping, grinding, etc.

We have seen a tremendous development in food processing during the past few years. Lack of equipment for the usual prewar processing methods, shipping space, and other more or less direct war influences have accounted for this expansion. Some of this expansion no doubt will survive, to take a substantial place among our peacetime industries. Where fruits are involved, the future looks brightest, particularly those enjoying an export demand and others where fine quality will have an appeal in domestic markets. Competition with other processing and storage methods, however, no doubt will place dehydration processing in a difficult position. Quick freezing, with its strong appeal for the storage of fresh products obtained directly from the farm and its adaptability to home-sized units for both rural and urban users, represents a postwar development which may be termed as having public acceptance ahead of consumer availability. The guidance of this step in food processing and storage is a peculiar responsibility of the electrical industry, for without electric energy this development would have difficulty in gaining wide public acceptance.

There are certain power fields in agriculture which are subject to greater electrification than at present, but these are strongly competitive with other forms of power, particularly the internal combustion engine. The use of the internal combustion engine for mobile types of farm equipment like the truck, tractor, automobile, combine, pickup baler, spray outfit, etc., is not likely to be dislodged because of the high degree of mobility involved. On the other hand, many stationary power operations are not yet electrified. There is upwards of 750,000 hp. of internal combustion engines installed on farms that may be classified as semi-stationary and stationary power types. Perhaps one-third of this might very readily be replaced by electric motors, when classified on the basis of power adaptation. The postwar period, however, will no doubt reveal an even keener competition for this power load than before. A large number of manufacturers are exploring the farm engine market for stationary and semi-stationary types in unit horsepower sizes for both liquid cooled and air cooled units. It is not unlikely that under this keen competition the outlet for mechanical power units on the farm will expand materially. It is well to remember that, no matter what the type may be, once installed, farm power change-overs are not easily accomplished. Aggressive action will be required to build up the electrical load in this area of farm power during the postwar years.

In general, we may look with confidence to the future of rural electrification in postwar agriculture. It is bright from the standpoint of potential opportunities to make rural California not only outstanding for the quantity and quality of its farm products, but no other region offers such attractions for rural living. We have every reason to believe that many will wish to take advantage of the opportunities rural California has to offer. It is, of course, most attractive for those who are willing to work and take the risks that private enterprise imposes.

The greatest barrier to a fulfillment of our postwar hopes lies in the dangers of an overzealous paternalistic government which could readily stifle competition so essential to the free enterprise system that is needed for prompt recovery from a war economy. Competition involves both profits and losses, but it is the lifeblood of progress. Without progress there is national deterioration. To attain progress we must think of our jobs as requiring hard work and sincere cooperation. We dare not think of the future in terms of charity or a continuing economy based upon unending expansion of public credit. It is time to hold the line and solidify our positions if we wish our nation to survive as a true democracy. Let us, then, devote our energies toward progress and a greater rural California in the postwar years which we all hope are near at hand.

C'MON OUT! IT'S COLDER INSIDE THAN IT IS OUT HERE. DO YOU SUPPOSE MA BLEW ANOTHER FUSE?
MAYBE HER THERMOSTAT'S DIRTY
HI CHICK! GET UNDER MY WING
G'WAN! YOU AIN'T A MAMA

Ultraviolet for Chicks

STUDIES recently conducted by Dr. Harvey C. Rentschler, director of the Westinghouse Lamp Division Research Laboratories, point to the fact that short-wave ultraviolet rays may reduce poultry mortality as much as 68% and that the small amount of Vitamin D produced by the bactericidal lamps contributes to speedier growth. Dr. Rentschler made a 12-month study of Sterilamps in 400 chicken, duck and turkey hatcheries and feeding stations.

In a test of two battery brooding houses, identical except that one contained bactericidal ultraviolet lamps, one hatchery reported 68% lower mortality and 50% fewer culls and runts in the house employing the lamps. Birds in the irradiated unit grew to range size in five weeks, compared with eight weeks for the unirradiated birds.

It was found possible to raise 1,000 pullets per battery brooder in the irradiated building, as against 750 in the battery brooders without lamps. Otherwise, the same sanitary measures were employed in both houses. The test involved 11,000 chickens.

"Losses during hatching have been reduced as much as 15 to 20%," Dr. Rentschler reported. He explained that the very high temperature and the high humidity necessary in the hatching compartment of an incubator stimulate rapid growth of the already considerable quantity of infectious organisms originating from the eggs themselves.

"Disinfection of the down-laden air in the hatching compartment of an incubator reduces infection to a minimum and gives the birds a better start."

The study also indicated that irradiation produces better feathers earlier and improved condition and coloration of legs and combs, less cannibalism and "picking."

The rod-shaped lamps, thinner than fluorescent tubes, are installed on ceilings or walls. In the hatcher Sterilamps are placed where they will irradiate the greatest open area and where the velocity of the air is at a minimum.

Preparing Planners for Postwar Homes

Electric home equipment and wiring taught in over-all building industry and school adult education program begun at Pomona

HOME making is a strong instinct. Even in wartime it finds expression in plans and dreams which can only be realized when the job of war is finished. But how strong that instinct is and how persistent is the planning is being found out in southern California in the first of a series of Home Planners' Institutes at Pomona. But for electrical people, anxious to see the homes built after the war adequately electrified, perhaps the most vital thing to know about this institute is how to go about setting up others like it in as many places as possible. Thus, instead of one successful institute, guiding 300 home planners in better thought out planning in one single community, similar institutes may be brought into being in hundreds of communities throughout the West to reach and teach thousands.

Details of the Pomona institute will be related, therefore, not as mere news, but as indicating a method by which other institutes may be started. Thus the experience gained in initiating that institute may more quickly be utilized to set in motion new institutes. The pattern itself is relatively simple and though there may be local deviations in details, the form and sequence may be accepted with confidence of success in results.

Leadership

Since every industry interested in home building is involved in a successful home planners' institute, the leadership may well come from any group and, if the electrical industry is not alert, it may find itself relegated to a minor part. In the Pomona institute, the leadership was taken by the utility, the Southern California Edison Co., and particularly by Henry C. Rice, merchandise manager. The local division manager at Pomona, Harold M. Moore, offered his office for a meeting place of the various interested groups to form the coordinating committee.

Coordinating Committee

This guiding committee was composed of three members and a chairman and the director of the program, Julien Brannan, of the adult education office, Pomona city schools. It met at the utility office, from 3:30 to 5:00 p.m. on Tuesdays. Its purpose was to set up a home planners lecture course for the people of the community as a non-profit, adult educational program, designed to aid community planning of postwar home building.

Specifically it set about to:

1. Arrange details, length of course, subjects, place of meeting.
2. Assist the program committee to obtain speakers.
3. Arrange for advertising and publicity for the course, arrange for collection of funds for advertising and plan for its use.

Promotion

A subcommittee on advertising and publicity was selected which was to

1. Prepare a descriptive booklet explaining the course. This was a three-fold card telling, on the first fold, "who, what and why", on the second side some of the feature speakers and their subjects, on the third side was a reply card with which to enroll in the course. On the back was a list of the 30 or more sponsoring organizations.
2. Distribute extra copies of the reply card to the co-sponsors and also prepare a coupon for them to run in their own display advertising.
3. Perhaps prepare a co-sponsor's folder to present to students in the course, to contain notes, papers, and basic information and to contain a list of the co-sponsors.

An estimate was made of the amount of money required to run display ads in local papers two or three times and to print the reply cards and descriptive folder. In this case it was $300, and among 30 sponsors that meant only $10 apiece, although many were willing to contribute much larger amounts. It was felt by the coordinating committee that equal participation by all was more important than large donations from any one group.

Those taking the class, it was finally decided, would provide themselves with a scrapbook at about 75 cents, and a text book, *Plan your house to suit yourself*, was recommended by the school but was not made mandatory.

The Lecture Program

The program had to be made to fit as closely as possible the requirements in time of a school semester program. The Pomona program was set up as a series of 17 lectures or lessons, each of two hours duration, 7:30 to 9:30 p.m. School men say that a minimum of 10 lectures is required and that if the preliminaries cannot be completed to get under way in time to allow at least that time the course had better be postponed to begin the next semester. A carry over of lessons from one school term into the next is not wise.

Four divisions were made in the program. They are:

1. Approach to planning a home.
2. Development of the plan.
3. Equipment and construction materials.
4. Adjusting desires to dollars.

Since the sponsors had much to contribute in basic information and advice to the education of the students, program committees were made up by the coordinating committee, assigning to them the responsibility of providing speakers from their industry. These program committees were composed of members from each individual industry. They were asked to submit suggestions to the coordinating committee and assist in procuring the speakers selected by the latter.

Electrical Program

Presenting the electrical part of home planning instruction is important and comes in at several points in the over-all program. First there is electrical inspection and rules for safe construction, presented by the city electrical inspector. Next is wiring. Then lighting, and finally electrical kitchen and household equipment.

At the Pomona series Melville G. Riddle, Pomona's city building and electrical inspector, gave the talk on the value of building and electrical regulations in the safety of the home

What the Program Does

1. Informs a large cross section of the public as to home design and layout.
2. Instructs them as to best methods and materials.
3. Shows them the most economical procedure.
4. Gives them technical information pertinent to building as regards foundations, building materials, plumbing, wiring, electrical equipment, paint and color harmony, and financing.
5. Tells them the methods of financing and budgeting and stimulates savings and War Bond purchases to provide funds for making their plans come true.
6. Keeps people level-headed because informed and thus less easily misled by fantastic schemes.
7. Acquaints them with the best new aids and gadgets.

and the need for sound construction.

A. B. Smedley, formerly of Anaconda Wire & Cable Co., now with Lockheed, and well known for his graphic way of simplifying and dramatizing the adequate wiring story, was the instructor on that subject. For lighting, both the interior and exterior story was provided in one double header program. R. A. Buckby of General Electric Lamp department, presented the interior lighting instruction. F. B. Nightingale, specialist and creator of garden lighting, presented that part of the home planning.

The home kitchen equipment part of the program has not yet been given, for the course began in January and is still in the "developing the plan" stage. But Rice plans to present from the electrical appliance industry a thoroughly practical session on kitchen planning and equipment.

The Pacific Coast Electrical Assn., through Victor Hartley, managing director, has cooperated actively in the entire procedure, finding in it a means of public instruction in the necessity for adequate wiring and electrical home equipment.

The General Committee

To acquaint all interested groups or industries and to enlist their support, a general meeting or two was held before the actual starting of the course. At this meeting each of the potential sponsoring organizations was asked to bring interested members and to contact others in their industries or related ones and invite them. At this meeting the outline of the program was given, the sponsoring groups enlisted and their support urged in acquainting the public with the institute through circulation of enrollment cards and running of coupons in their own display advertising.

Sponsoring organizations in Pomona numbered about 30 individuals, such as builders, architects, contractors; several home furnishings stores, several lumber dealers, tile, paint and wall paper, building and loan and banking institutions, as well as the realty board, the building contractors' association, master plumbers, brick institute, lumbermans' association, the utilities — Southern California Edison Co. and Southern Counties Gas Co. and the State Association of California Architects.

Pomona school officials welcomed it as a practical cooperative community enterprise in which the adult education program could serve.

In describing the organization of a similar program, Rice lists a number of trade groups which should be contacted and their support enlisted. Some of them, particularly the lumber associations, are already busy sponsoring similar plans throughout the land. It would be wise for electrical industry people to get into such programs to see that the electrical story is not neglected and is told adequately.

Among the groups to be enlisted he names architects, building contractors, flooring, painting, cabinet making, title, real estate, redwood, roofing, savings and loan, plasterers, electrical contractors, paint, varnish and lacquer, plumbers, metal trades, metal lath, cement, clay products, nurserymen, retail hardware, lumber, banks, brick, tile and glass associations, bureaus or institutes.

Results

Enrollment in the Pomona institute surprised everyone. Indeed the high school auditorium selected for the classes almost proved too small when 350 attended the first class and signed up for the course. Attendance at subsequent meetings has been high and interest is keen. This indicates to its sponsors that people are doing a lot of planning to build and want competent instruction to guide them.

One of the advertisements which brought large attendance to the classes in postwar home planning

Seeing the response at Pomona, the sponsoring groups have been eager to get more institutes started in other cities. A committee has been organized to present a similar course in Santa Barbara and preliminary negotiations are on for one in Orange County. Inquiries about the movement have been received even from London and from several eastern cities. Thought is being given the plan in northern California as well.

Rice estimates that there will be some 50,000 houses built in southern California in the five years following the war, a majority of them under $6,000 in price. This program has possibilities of reaching a large number of those potential home builders and of guiding their thinking. If these people ask for electrical facilities, it is likely to set a pattern among speculative builders to include more electrification in the product they will build for the market.

Those attending represented all ages, young war brides who dream of a future home when their husbands return as well as middle aged and elderly people who still want a better planned home than the one they are living in

● Monthly Reports of sales to dealers have been continued again by Southern California Edison Co. Says H. C. Rice, manager of domestic sales, in his letter to dealers, "We propose to continue sending you the form for your monthly reports of sales, even though we are aware that very little, if any, merchandise is available, because we want to keep in contact with you."

Tacoma Simplifies Servicing

System developed to give customers immediate charge for range repair service on the job

WHEN Tacoma City Light found, in the fall of 1942, that range service calls were rapidly reaching the point at which they would swamp both repairmen and office personnel, the range service department determined to re-tailor procedure to fit the times. The new plan, which involves immediate billing by the repairman, is a composite of the suggestions of the entire group.

Conferring members of the department were unanimous in pointing to two places where revisions would save time and money. First, customer billing could be simplified to conserve manpower and reduce the number of uncollectible accounts. Second, revision in the method of ordering special parts would step up delivery and so cut the time between the first call and completion of the repair job, sometimes six months.

These problems were tackled by a representative group, including the range department supervisor and foreman, storekeeper, collector, bookkeeper and chief clerk. The plan evolved was based on a system used by Georgia Power Co. and according to J. M. Power, range department supervisor, has resulted in more calls with fewer call backs, which, in turn, has brought increased customer good will and operation of a necessary service at a profit.

The new plan, which uses two forms where four were used previously, calls for cash on completion of the job, with a 30-day charge privilege. With wartime manpower shortages in the accounting department, past due statements on range repairs had been running as much as 30 days late. When this 30 days was added to the eight or ten days before invoices were mailed and the 30 days allowed before delinquency, 70 days could elapse between completion of the job and mailing of the past due notice. In this time, a few customers had moved, leaving no forwarding addresses, and the utility couldn't collect.

The new work sheet is filled out in triplicate by the repairman and covers the entire transaction, including work done, parts used and amount due. The original is turned over to the bookkeeper and becomes the ledger sheet, the duplicate goes in the shop records, the triplicate is left with customer.

If the customer asks for the 30-day charge privilege, the utility issues a payment form, the size of the regular utility bill and showing only name, address and amount due. This form is mailed along with light, water and garbage bills, enabling the customer to pay all four at one section of the treasurer's office. It is made up in duplicate and, if the account is unpaid at the end of 30 days, the duplicate is turned over to an account collector.

Under the old system, the repairman filled out a work ticket showing labor and parts supplied. This was signed by the customer when the job was completed. From this ticket, a range repair report was made up and priced. An invoice was then prepared for the customer, with a duplicate for the ledger sheet. A fourth form was used for contract and overdue billing.

As a natural result of this system, the customer sometimes retained an incorrect impression of the transaction and, when the itemized statement arrived eight or ten days later, disputed the charges. Power reports that when the customer gets his itemized bill at the time work is completed, disputes rarely occur. Credit memos or write off slips are practically unknown now, he states.

Since cash collection by the workman is a part of the new system, money bags have been furnished and each serviceman carries $25 in change. At the close of the first five months under the simplified plan, charge sales accounted for 53.88%, cash sales for 46.12% of volume. Unpaid accounts amounted to only 9.239% of the total.

Providing a daily check on the work sheets, a range repairman's daily assignment sheet is kept. This form has a place for ticket number, name and address of customer and disposition

CITY OF TACOMA
Department of Public Utilities

LIGHT DIVISION
RANGE REPAIRMENS DAILY ASSIGNMENT SHEET

Not Home-NH; Not Finished-NF; Did not Get-X;
Wrong Address-WA; Hold Till Notified-H; Order-O

Ticket No.	Name	Address	Disposition	√

Number of Tickets Checked Out . . . Checked In . . .
Range Repairman . . . . Date . . . . Checked by . . .

Repairman's daily assignment sheet provides daily check on work sheet

This work sheet, filled out in triplicate, covers the entire transaction

FORM L58

CITY OF TACOMA
DEPARTMENT OF PUBLIC UTILITIES
LIGHT DIVISION
APPLIANCE DEPARTMENT BR. 3141 EXT. 290

ORDER NUMBER 5062

DISTRICT _____
CHARGE TO _____ DATE _____
ADDRESS _____ TELEPHONE _____ M.R. _____
DIRECTIONS

APPL. _____ MAKE _____
MODEL _____ SERIAL _____
PARTS NOT IN STOCK ORDERED
DATE _____ ORDER _____
TOP UNITS
OVEN UNITS
SWITCHES

NATURE OF WORK REQUESTED
ORDERED BY
ADDRESS
REMARKS

MATERIALS USED

TOTAL MATERIAL CHARGE
LABOR
STATE SALES TAX AT 3%

NOTIFY | NOT HOME | ORDER | WILL CALL

PAYMENT RECEIVED IN AMOUNT $ _____
THIS IS YOUR INVOICE
PLEASE PAY REPAIRMAN

APPLIANCE UNDER GUARANTEE
DATE SOLD _____
RANGEMAN _____
REPAIRMAN _____
CUSTOMER'S SIGNATURE _____
PAYMENT ON ACCOUNT
BALANCE DUE, IF ANY

of the call. A code is used to mark in such information as customer not home, job not finished, wrong address and so forth.

When the new system was started on April 1, 1943, newspaper advertising and the utility's monthly bulletin called public attention to the change, told the reasons for it.

This advertising stressed the desire of the utility to save the customer's time in these war busy days; pointed out that, if the customer did not wish to pay on completion of the job, he would be sent a statement which fitted into the regular teller machines so that all utility bills could be paid on one trip to the city hall. There was also a reminder that WPB regulations required an old part to be turned in for each new part issued. The bringing of an old part to the department when applying for a new one was counseled.

Those cooperating in planning and perfecting the new system, in addition to Power, were Harry Berg, chief clerk, Ed Faker, storekeeper, M. J. Fiddes, collector, Fred Hepp, accountant, Walter Nelsen, bookkeeper, K. W. Ohiser, advertising, Carl Ostland, foreman.

● YOUR HIDDEN TREASURE, a convenient booklet containing information as to the current tax program, inflation, real income, and providing an income record and a family budget service, has been given by Nash-Kelvinator Corp. to every employee. The new edition for 1944 contains 60 pages of useful information and record forms, many of them requested by employees after last year's similar booklet.

● REDDY KILOWATT has been adopted by the Southern California Edison Co. and reported for work in early January, according to Ashton B. Collins, originator of the character. For many years this company had a trade character named "Busy Button," the creation of the late Richard E. Smith.

In the Kitchen

Women tell what they like and what they dislike

RIGHT from the kitchen sink came the observations which Miss Claribel Nye, California state home demonstration leader of the University of California Extension Service, gave the San Francisco Pot and Kettle Club at its meeting Feb. 18 regarding the wishes of women in respect to home equipment and appliances. Heading a staff of 36 economists and home demonstrators working in 32 counties of the state with the farm bureaus, she had the results of a survey of housewives as to what they like and do not like about home equipment. Among her observations were:

Washing machines—the automatic is very much desired and preferred. What is really needed in many parts of the state, however, is an inexpensive built-in water softener to be used in conjunction with the washer.

Dish washers—those who have them are thrilled with them but not many use them. However, interest is awakening and she believes they can be sold after the war in large quantities.

Ironers—a great many as yet do not know how to operate them but those who have them are extremely proud of them. Through demonstrations more and more women are coming to learn their value and they should sell briskly after the war. Demonstrations are better when conducted among the women rather than from a platform.

Mixers—most women want them but there is a definite need for one with a stronger motor so that there will not be the necessity to put on a power unit for heavier mixing and beating jobs.

Ranges—oven regulation is very much in demand.

Price range—There is need for a range of prices in all appliances. There should be cheap editions.

Frozen food storage—she believes this will be the preferred method of home food preservation. When the war is over, home canning and dehydration are very likely to go out of the picture and commercially canned products are not as attractive as frozen foods. The frozen lockers are in great demand. Larger units will be needed for home storage on the farms in order to hold more meat storage. She feels there will be a definite trend toward home storage of more frozen meats and that the boom in frozen foods which was coming rapidly at the beginning of the war will really blossom after the war.

Storage space—kitchen conferences held by home economists in actual homes and try-outs of rearrangement of storage in the kitchen point to more efficient storage usage with cabinets designed to provide it. Women are interested in functional storage, she said.

Heating—Women want homes where the floors are uniformly heated. They want rooms with walls that can be moved or adjusted to suit the needs of children, guests or adapted to changes in furnishings.

Care of equipment—it was found that women do not read the commercial directions that go with electrical equipment. Nine out of ten do not know where to find the instructions that were furnished. She believes salesmen should take time to go through the instructions with a customer on making a sale. Customers need to respect the equipment and understand its operation. During this wartime women are afraid of doing much with their equipment, yet upon being trained are found to be deft with their hands and, as they build up confidence, they do a great deal of maintenance. "Do not belittle a woman's ability by telling her that it never needs care or attention but help her and show her how to do it: build up her confidence in doing so."

With new electric appliances out for the duration, Idaho Power Co. has about a dozen men at work in its Boise division service department to handle the ever increasing influx of appliances needing repair. Below, left, is C. V. Davis, foreman. Center, two of the workmen, Dale Livingston (left) and Norman Alloway. Right, transformer repair facilities also are headquartered in the Boise service building. Electrician F. D. Rose stands in a corner of shop

Life In Old Mart

Still no appliances, but distributors on deck

MARKET week came around again, Feb. 7-12 at the Western Merchandise Mart, San Francisco and the slumbering giant, the dormant electric appliance industry, stirred in its sleep.

There was no electrical merchandise to be seen, to be sure. But the distributors were on deck, greeting dealers who really flocked to the market looking for something to sell, assuring these dealers that they were not forgotten and that when and as merchandise becomes available they will get it to sell. Some independents have lines of almost everything else but electrical appliances and these were busy taking orders for what they had to sell.

Retailers, the Mart staff says, are showing remarkable staying power and even two years of scarcity and curtailment has not killed them off. This will-to-endure is one of the promising and hopeful signs for the future. There wasn't much "deploring" of the state of things; more exploring for what there might be to sell to tide the long appliance drought.

Kelvinator's Weingartner had a desk, some calendars, the Kelvinator *Postwar Planning Guide*, and a pleasant smile for dealers who dropped in.

Crosley Corp. and its distributor, California Electric Supply Co., had a desk at which N. B. Dinkel, Western regional manager, and California's Timberlake chatted with dealers.

General Electric Supply's space was attractive with war product displays, the two most attention capturing being the compact and rugged two-way radio set built for tanks and the much discussed wire recorder, which is used in planes by pilots to record their observations over a target. Several of the staff were on hand each day.

Leo J. Meyberg Co. had displays of its wiring devices, radio supplies, records and cabinets and a victory range (gas). The Norge and the Bendix that were displayed were really only shells. Many dealers who tried to buy them learned that regretfully.

H. R. Basford Co. said, "call it a museum, for we have nothing here to sell." It displayed a tempting radio cabinet and some phonograph records but would take no new accounts; was just on hand to greet its old friends.

No Blackstone was to be seen under the neon sign in the C. G. Hamilton booth, but there were kitchenette tables and an ice refrigerator.

Easy Washing Machine Co. has its Western office in the Mart and Fred Fenton was on hand to talk better times ahead with dealers and discuss any parts and servicing matters they had in mind. Fenton is hopeful that a few washers may be made late this year.

Westinghouse also has the Western offices of its merchandise department in the Mart and had attractive display of wartime production photomurals and a list of wartime services—"electronics consultant, modern lighting, appliance service, department consultant, postwar planning, local lighting, coffee makers, and vitamin, nutrition and kitchen planning." It also made daily showings of the film, *ABC of Electronics*. Westinghouse Supply Co.'s Barker and Bill Miles were also on hand to discuss their selective dealerships for after the war.

Thompson & Holmes had one electrical product to offer, the green inside-frosted Verd-a-ray lamps. But it also showed a variety of merchandise from baby buggies to wax and paint.

Dunham, Carrigan & Hayden, always hardware jobbers, were not missing their refrigerator and appliance lines so much because they had such a variety of other gadgets and housewares.

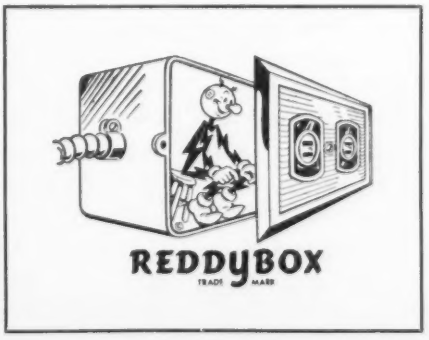
Aladdin Lamps, surprisingly enough, had quite an ample display of floor and table lamps.

Stromberg-Carlson, whose Western offices are in the Mart, just tended to its very important war production knitting in its corner of the fourth floor.

Reddy Wiring

To popularize and humanize the wiring in a home, Reddy Kilowatt, brainchild of Ash Collins, who is employed by so many electric power companies to symbolize electric service, has come forth with two new ideas which, while simple, hold the potential for a new approach to the age-old wiring problem.

To make the public conscious of the wiring inside the walls Reddy appears in an outlet box in a new copyrighted drawing, which is aptly called a Reddy-box. Hitherto Reddy has always appeared stepping out of the outlet fitting itself or alone performing his many electrical tasks dressed in various working costumes. To show him in the Reddy-box from which he comes takes the customer back of the wall into the wiring and is designed to awaken a consciousness of that wiring.



Another development to Reddy in his trade character form is the addition of a catchy action provoking slogan, "Plug in—I'm Reddy!" either in the form of a balloon coming from Reddy Kilowatt or run in type just above the standard trade symbol showing him emerging from the wall outlet.

In calling attention to the possibilities with these two ideas, Collins, in a plan book called *The Master Link* asks what it would be worth to other industries to have a trade mark on every living room wall in the nation. Yet the electrical industry, by linking the millions of face plates of electric outlets in the nation with the symbol of electric service has the equivalent of such a trade mark at each one.

Hawaii Reports

Because of delayed mail transmission reply of C. E. Nolan, manager, promotion department, The Hawaiian Electric Co., Ltd., of Honolulu, in respect to causes for increased domestic kilowatt-hour annual consumption was too late for the February issue. It is interesting, however. He says: "My explanation as applying to Honolulu is that owing to the severe housing situation, many more people are living in the same dwelling than prior to the war—hence greater use of electricity. Second, owing to local blackout restrictions and restrictions on travel on account of gasoline, many people stay in their own homes instead of gathering in groups as heretofore. Consequently more homes are lighted. I think another reason is that more people cook at home on account of the restaurant situation and therefore make greater use of their appliances. At least this is the way I look at it locally."

Please Note

In reporting electric customer and consumption figures in the February statistical issue, p. 78, a mistake was made in the San Diego Gas & Electric Co. data. Figures for 1941 and 1943 were transposed, showing a loss instead of the gain which was made by the utility.

The figures should read:

Average annual kilowatt-hour consumption, residential: 1943—1,135; 1941—1,048.
Total all customers: 1943—126,178
Residential customers: 1943—105,753
Commercial customers: 1943—15,347

ELECTRICAL WEST

McGRAW-HILL COMPANY OF CALIFORNIA
68 POST ST. SAN FRANCISCO 4

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Power Pooled for Victory

POOLING of all power resources in the five Pacific Northwest states—private, municipal and federal—into one of the nation's most outstanding wartime power pools is described elsewhere in this issue. This achievement, of which the whole industry can well be proud, is noteworthy in many respects. First, the whole pool organization and operation has been voluntary. Its genesis and its principal aim have been to harness the resources of the power industry for the quickest possible victory. Secondly, the tangible benefits have been particularly imposing and notable. Most outstanding has been the release of 100,000 kw. of additional capacity for vital war industries, occasioned by the great diversity of loads and resources of the eleven major systems comprising the pool.

Successful operation of such a complex network consisting of 13,000 miles of major transmission lines linking together 150 scattered power plants is a major engineering feat. That all of the problems of stability, circuit breaker interrupting capacity, relaying, telemetering, communication, scheduling and accounting have been met successfully reflects credit to the power engineers of the region. They have combined the knowledge and experience gained in pioneering system interconnections since the first one way back in 1915 into a major contribution toward winning the war.

Most commendable aspect of the pool is its purely voluntary character. No laws, edicts, directives or orders were required to bring it into being. It was mutually advantageous and it would make victory quicker and more certain. And it would save manpower and materials. Those were reasons enough for its genesis.

The future possibilities of continued pool operation of these resources fire the imagination. Wartime operation problems have been so pressing that all economic benefits have not been fully explored. Experience to date has been sufficient to demonstrate that economic benefits thus far evident warrant similar peacetime operation with the same splendid spirit of cooperation that has been displayed in time of war.

No Business for the OPA

FREQUENT warnings have been sounded in these columns against the progressive intrusion of federal agencies into matters strictly within the province of state regulatory commissions. Whatever incidents might have occasioned prior admonitions pale into insignificance when compared with the brazen and officious intervention of the OPA into the $1,500,000 rate litigation of the Utah Power & Light Co. By entering in the Utah State Supreme Court test case, the OPA is setting a dangerous precedent.

That the action lacks popular approval is indicated by the indignant wave of editorials in the Utah press. In a particularly noteworthy comment, the *Salt Lake Telegram*, without taking sides in the rate controversy, says:

"We are simply arguing that the regular agencies established by Utah to regulate public utilities and fix fair and reasonable rates are fully competent to handle the matter without any help—or interference—from OPA.

"We think the state public service commission ought to resent that interference — and that it should say so. If it values its independence, and has any regard for its responsibilities as a regulatory agency of the state government, it will decline any support of its argument from a federal agency. For if it accepts support, it will have established a precedent for the acceptance of federal intervention, which next time might not be support.

"Heaven knows, our local governments have little enough independence and power left to them. They had better cherish zealously what they have and vigorously oppose every attempt at interference by any member of the vast army of federal bureaucracy.

"After all the OPA was not established to interfere with the normal operations of business or the normal prewar price structure. It was not set up

to reduce established prices, but to prevent zooming wartime prices.

"Now the Utah Power & Light case does not involve price spiraling, an increase in the cost of living, war profiteering or inflation. The rates under question were not fixed as a result of changes in marketing conditions arising out of the war.

"Where, then, does the OPA have any business entering into this case? It smacks of unwarranted federal interference in a purely local matter not directly connected in any way with the war. It has a suspicious air about it, too, of a desire to get in on a prospective rate cut so that later, for political reasons, it can point to any saving effected for power customers as an OPA achievement."

To which everyone who looks with disfavor upon the mounting tide of federal bureaucracy will say, "Amen."

Change of Pace

LIKE the tricky backfield runner in a football game, shifty because he changes pace suddenly, war requires sudden changes of pace and direction in order to spring surprises on the enemy. In meeting the needs of war, civilian economy must be capable of shifting with the strategy of the fighting front. Again, as in football, the line and the backfield must be quick to take advantage of whatever twists and turns the man with the ball may take, be ready to receive a pass or to lateral it to another runner. So it is in war.

We are emerging from the first phase of our two-hemisphere war. The first phase was that of tightening the defense, getting the ball in our possession and turning from a defensive to an offensive line of action. America was asked for all-out production. Possibly no one knew what the total productive capacity of this nation was capable of turning out once it started.

Now comes a shift to directed production in specific materials and equipment. It means sudden changes, cancellations of contracts and reduced production in some things. It means reshuffling of the manpower formerly engaged in all-out producing. It is a change of pace, a quick turn in direction. It will hurt many, cost a great deal in some instances. It means more adjustments, material and human.

In the immediate foreground for this industry is a stern adjustment that must be made in manufacture of equipment and devices used in building up the huge war plant. Wiring supply surpluses already loom as a serious distribution headache. Utilities face more shifts in industrial load with this changing phase of the war. Contractors and labor face some idleness until they are assigned new jobs to do, perhaps in maintenance of plant and equipment.

While our Army and Navy make new gains and turn the war into one upon the enemy, our home front backfield shifts must be made without once interrupting the support needed at the fronts. The electrical industry should gird itself to take these new changes of pace and tactics as necessary and normal to war, and again demonstrate that our American way of life is faster in footwork than any goose-stepping competitor anywhere.

Instruct Home Planners

TOO late, therefore too little, it might be said, has been the situation in respect to home wiring. The industry reaches the customer too late with its message, after the house has been built and moved into; therefore too little wiring has been installed. But in southern California today a way is being found to reach many of the postwar customers who will build homes and to inform them constructively as to the wiring they should require and have installed.

Interest is keen these days in the homes that are necessarily deferred now on account of war. The remarkable response to the invitation the Pomona Home Planners Institute ran in newspapers and the fine attendance at each of the series of classes attest to that keen interest. The wiring and electric home equipment part of home planning, too, comes in naturally as a vital necessity in good, sound construction. This pattern is well worth use to lay out similar institutes throughout the West.

NOW if you want to get a measure of your own company's wartime position from a public relations standpoint, just apply the micrometer. Take three dimensional measurements: First: How good a war production job has your company done? For the doing of the job well is the first dimension *of public relations. Second: Have you told the public within censorship limitations about the job done? For telling about the job done is the* second dimension *of public relations. The doing is more important then the telling. But the doing alone is not enough. Third: What have you done beyond the mere telling to explain HOW you are able to do the kind of a job you are doing? For unless you give people an understanding of the "how" and "why" you have not developed the* third dimension *of public relations. Knowing how is what makes the idea stick.*—Paul Garrett, vice-president and director of public relations, General Motors Corporation.

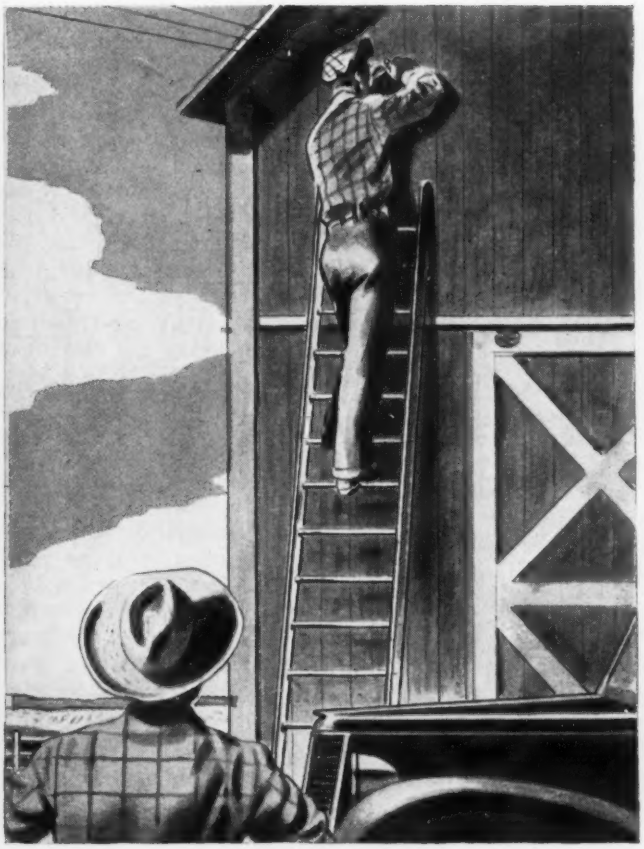
Four ways to prevent a postwar slump in power

1. All over the country, families are busily planning postwar homes. General Electric is helping them plan, mailing out vivid, convincing advertising . . . to persuade prospective homeowners, builders, architects to create *all-electric homes* . . . with ample wiring, plenty of outlets, and all the built-in home appliances they need. That's ONE way of sustaining the present power demand in a postwar world . . .

2. *Another* way to make continuing use of utilities' added wartime capacity is to promote the enormous advantages of an *all-electric* kitchen for people who have already built and own their own homes. General Electric is directing special attention toward this group, especially featuring individual appliances like the electric sink, refrigerator, range, and water heater. Recent surveys have shown that thousands of people in this class offer a rich potential market for power in postwar days. General Electric is cultivating these people . . .

Tune in: "The G-E All-Girl Orchestra" Sunday 10 P. M.—E.W.T. NBC

demand



3. There's another peacetime objective for utility companies to consider, one that demands the most careful and effective kind of approach—that is the enormously increased number of after-victory farm homes that will be electrified; a reasonable estimate places this at 300,000 homes per year, all potential users of electricity. A worth-while load-building program directed especially toward them is imperative. They provide the largest logical outlet for increased load-carrying capacity.

4. All this *extra* capacity, built up at considerable wartime expense, demands serious attention from utility companies and General Electric alike. A united effort, concentrating on a definite load-building program for both rural and urban areas, will bring proper returns on that wartime investment. A huge sales potential is there, awaiting "two-way" cultivation. And working together, we can soften the expected "big drop" into a barely perceptible jar.

Everything Electrical for After-Victory Homes

GENERAL ELECTRIC

General Electric Appliance and Merchandising Department
Bridgeport, Conn.

• "The World Today" news every weekday 6:45 P. M.—E.W.T. CBS

PCEA Panorama

Edited by Mary Shoop

Spring Conclaves

Meetings at Los Angeles and San Francisco scheduled

THERE will be PCEA spring conferences this year. The board of directors has decided that, due to the valuable exchange of ideas to solve wartime problems achieved by the conferences, they will be held this year sometime in May. To solve transportation difficulties, two one-day meetings will be held—one in San Francisco for PCEA members in the northern part of the state, and one in Los Angeles for those in the southern region. The exact dates are being determined by President Frank Angle and the chairmen of the three PCEA sections, and will be announced in next month's ELECTRICAL WEST on the Panorama page.

The annual meeting of the association will be combined with the San Francisco conference. At this time officers for the new administrative year will be elected, including president and nine directors to succeed those whose terms will expire.

Study Indoor Climate

A cooperative movement in the field of air conditioning is being watched with interest by PCEA. Termed the Indoor Climate Institute, the organization covers every phase of the air conditioning industry, including air cleaning, cooling, heating, circulating, insulating, etc. Its purpose is to promote the principle of air conditioning, without reference to competitive means of accomplishing the desired result. PCEA is maintaining close contact with the activity so that if such a committee be desirable at a later date, it could be organized through existing industry associations rather than creating another organization for this purpose.

● RESOLUTIONS of sympathy upon the passing of two prominent members of PCEA have been sent by the board of directors to the bereaved families. The resolutions committee has sent the association's message to the family of the late E. B. Criddle, a past president of the association, and to the family of the late A. C. Joy, who served the association in a great many capacities for many years.

Who Am I?

I was born in Livermore Valley, Alameda County, Calif., July 8, 1889. I was graduated from Livermore High School and attended Stanford University, where I received a bachelor of arts in electrical engineering in 1911. After taking graduate work "in absentia" from 1926 to 1927, I received the degree of electrical engineer in 1927. Who am I?

In 1911 I entered the test course with the General Electric Co. in Schenectady, N. Y. From 1912 to 1914 I worked with the Portland, Eugene and Eastern Railway on the electrification of 100 miles of steam lines. I entered the engineering department of the Great Western Power Co. in 1914 as electrical designer, and continued with the company until 1920, except for time out in the Navy in World War I. I started with the Pacific Gas and Electric Co. in 1920 on the design of hydro plants on the Pit River system and continued in the division of hydroelectric and transmission engineering until 1935. I spent 16 months as technical assistant to P. M. Downing, vice-president and general manager, and in 1936 was appointed assistant engineer of maintenance, my present position. My work is entirely in connection with maintenance of the hydroelectric properties.

I am joint author with Roy H. Wilkins of the book, *High Voltage Oil Circuit Breakers*, published in 1930. At the request of International Correspondence Schools, I prepared the text for their books on *Hydroelectric Power Stations*. Who am I?

I was placed on the honorary retired list of the U. S. Naval Reserve in 1940 with the rank of lieutenant. I was an ensign in World War I and served as junior engineer aboard the *USS New Mexico*, first electrically propelled battleship. In 1928 I participated as a reserve officer in the trial runs of the *USS Lexington*, now sunk in the Pacific.

I am married, have two sons, one a pilot of a Marine dive bomber in the South Pacific. I live in Redwood City and my name is: See page 107.

Pass Resolutions

Adequate wiring urged in recommendations to Industry

TWO resolutions on pertinent industry matters have been prepared by PCEA, following the approval of the board of directors at their meeting in Los Angeles Feb. 17.

Acting on the recommendation of the adequate wiring committee, the board authorized the preparation of a resolution recommending the amendment of the National Electrical Code to prohibit domestic circuits of less than 20 amp. in wire capacity and circuit protection. Copies of this resolution are being sent to interested organizations throughout the nation to enlist their support in the movement to amend the Code.

Success of this movement would eliminate No. 14 wire in house wiring circuits, a desirable objective dictated by the trend toward increasingly higher wattage appliances.

The other resolution is being sent to electrical manufacturers and other interested organizations, urging the adoption of the practice of incorporating a slogan relating to the importance of adequate wiring within each piece of advertising. This would have a tremendous mass effect in creating even further public recognition of the need for adequate wiring.

Wiring Appraisal Chart

An Adequate Wiring Appraisal Chart is being developed by the Adequate wiring committee of Pacific Coast Electrical Assn., headed by H. C. Rice, merchandise manager, Southern California Edison Co. Finding that appraisers and financial consultants of building and loan companies and banks had no means of checking the amount that should be allowed for an adequate wiring job in a house for which they loan money, Rice has started work on the development of such a chart. It is to be limited to houses to cost under $8,000, under the presumption that houses of more expensive types may well have architects or engineers who will provide more adequate wiring.

Basis of the chart is a 4% of building cost total for the wiring itself. On this basis a $5,000 home would have allotted to it $200 for fully adequate

THE SCENE: Lighting Conference

THE VOTE: MILLER Fluorescent—Unanimous

Lighting meetings like this have happened many times in the past in many a busy war plant—will happen many more times during crucial 1944. Inevitably the vote goes, hands down, to MILLER 50 & 100 FOOT CANDLERS, and here's why . . .

PLANT MANAGER—"We still have stiff production quotas to meet—with greener help. MILLER 50 & 100 FOOT CANDLERS will give us 30, 40, 50 or more foot candles of illumination—and that's what we need for better, faster production."

WORKER—"Sounds good to me. I've worked under MILLER fluorescent and I know I've worked better and felt better simply because I could see what I was doing at all times clearly and sharply."

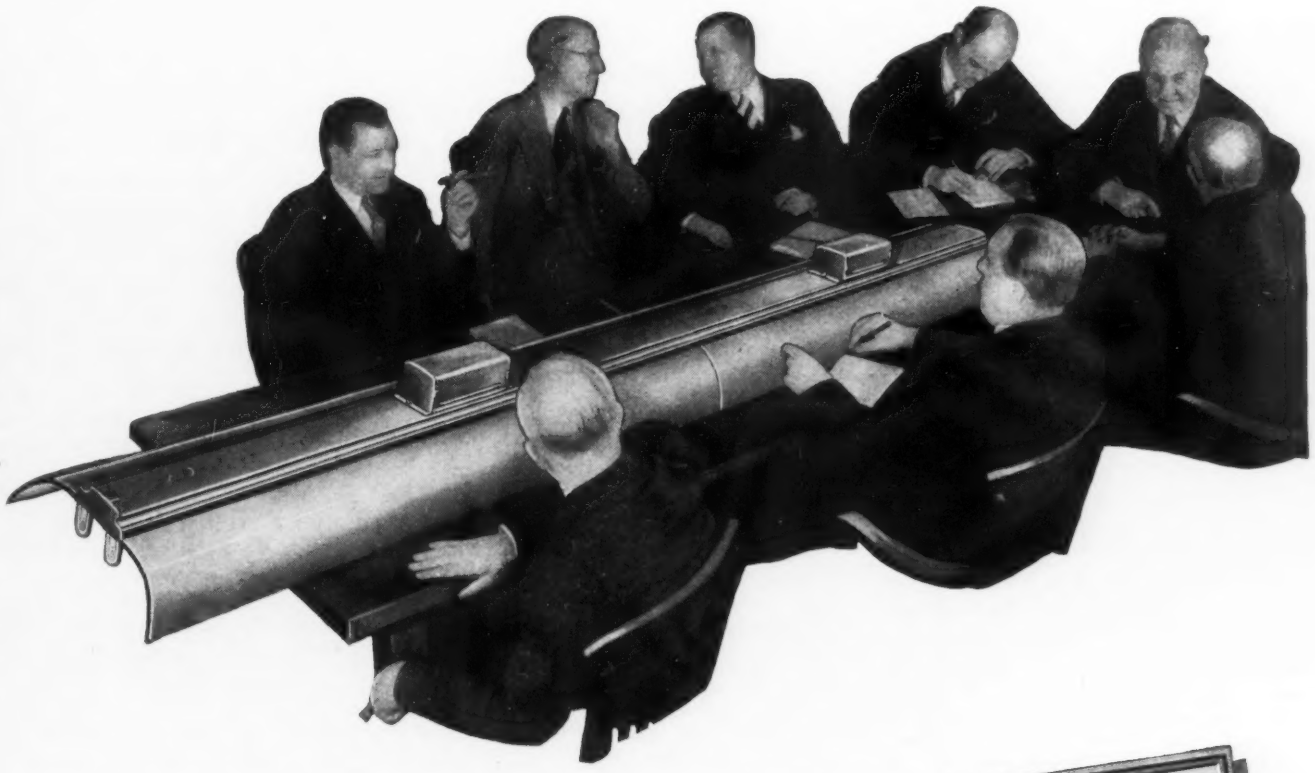
MAINTENANCE MAN — "Those lightweight Masonite reflectors MILLER uses will take plenty of punishment, and yet a girl can handle their cleaning. I like the exposed ballasts because they mean cooler operation. And I go big for that MILLER Patented Safety Lamp Lock that keeps lamps from falling."

ELECTRICAL CONTRACTOR — "I can handle the installation of MILLER equipment in less time, shorthanded as I am for trained help. Units go together easily into self-aligned runs. Hanging is simplified. I've had MILLER jobs result in installation savings of 30 to 50% to owners."

ARCHITECT — "I've specified MILLER Continuous Wireway Fluorescent Lighting Systems on both new construction and modernization projects. The beauty of it is its flexibility. Whole sections, or even the entire system can readily be moved to other parts of the plant."

UTILITY ENGINEER — "From power source right through to controls, the whole MILLER setup saves considerable critical material—and provides an adequate, modern lighting system . . . something we utility guys have been preaching for years."

OWNER — "You fellows hit both my pocketbook and my patriotism. I say let's specify MILLER 50 & 100 FOOT CANDLERS—and let's get a MILLER field man in pronto to talk turkey."



THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

wiring job; an $8,000 home $320. The various factors which would be checked by the appraiser in allocating money for a loan are given point ratings and also dollar values in each bracket of home price.

For example, the basic main service gets 1/8 of a total of 400 points, or 50 points. Lighting wiring gets 1/8. Other items checked are switch wiring, convenience outlet wiring, doorbells, range wiring, water heater wiring and bathroom heater and wiring.

The chart is still being developed but as soon as it is completed a copy of it will be reproduced in ELECTRICAL WEST. Building and loan companies contacted have expressed enthusiasm for the idea as a protection to their investments.

NECA In New Offices

Northern California Chapter, National Electrical Contractors Assn., moved into its new offices, Room 465-A, Western Merchandise Mart, 1355 Market St., San Francisco, early last month and held its first directors' meeting there Feb. 10. William J. Varley, Western field representative of NECA, also makes his headquarters there.

T. L. Rosenberg, Oakland, president; W. A. Cyr, secretary, and W. J. Varley held three meetings in the San Joaquin Valley with the electrical contractors of Stockton, Fresno and Bakersfield. They outlined the new chapter program, discussed details of its operation and set forth its aims. Adequately financed on a percentage of volume basis, the chapter will have a field representative available to contractors and local associations to assist them in labor matters and negotiations with government awarding authorities, general contractors and the industry. A master labor agreement is being sought for the entire northern California area to provide uniform working conditions and working rules, even if the scale may differ in slight degree in certain areas. Preparation for postwar expansion of construction business is also on the program of the chapter.

Northern California Chapter of the IAEI plans a meeting at Underwriters' Laboratories, 500 Sansome St., San Francisco, on the evening of March 15. Demonstrations of the testing equipment and procedure to be found at this laboratory will be made by Howard Dodge and his associates on the staff of Underwriters.

Southern California Chapter, IAEI, has two meetings scheduled, one March 22, at the Inglewood Country Club and, as has been the habit for many years, the May 24 meeting at Long Beach, Calif. Inspectors' problems are on the agenda in both instances.

RMEL Meets

Problems of manufacturers, jobbers, dealers studied

PRESIDENT C. C. Baker officially took over leadership of the Rocky Mountain Electrical League when he presided at the Mid-winter conference of managers in Denver, February 4 and 5. This meeting was notable in that electric utilities in Colorado, Wyoming and New Mexico were unanimously represented by their presidents or executive heads and tackled first things first, calling them by their recognizable names.

After discussion of the serious jeopardy facing manufacturers, jobbers and dealers as a consequence of immense stores of war goods now in possession of the government but available, in many instances, for speculative purchase by civilians, a committee was appointed with instructions to report recommendations for RMEL's course of action to help control this situation. The result of their studies will be presented at the league's Spring Rally, April 11-12, in Denver, when engineering, accounting and commercial divisions will hold meetings simultaneously. Sam G. Hardin, chairman of RMEL's distributor division, declared that all branches of the electrical industry, together with business generally, will suffer if distribution conditions stemming from release of new and used materials by federal agencies are not handled with due regard for the economic processes now prevailing in the nation. He predicted that calamity would ensue if some effective safeguard is not provided.

Among the war-borne threats that face electric utilities and associated businesses is the prospective invasion of the power service field by the packaged Diesel engine, wind chargers and gasoline engines adaptable for commercial establishments and small manufacturing plants. This phase was dealt with in a report by L. W. Edwards of the engineering division and submitted to the Power Sales section for solution.

Disturbing reports of REA's encroachment into the private utility field challenged the attention of the executives: REA's open defiance of state authority to exercise jurisdiction over cooperative power projects; paralleling existing distribution lines; acquiring towns of more than 1,500 population, and selling power at less than cost were a few of the items under discussion. The Wisconsin Municipal Utilities Assn. and other organizations' action to compel REA to stay within its proper realm was cited as an example of what must be done by private enterprise if it is to stay solvent; and the announced intention of cooperative REA interests in Oklahoma that their objective is to drive private utilities out of business was cited as one of many instances bearing on the *intent* of government-sponsored projects.

Powerful committees to perfect plans for dealing with predictable situations were appointed, and charged with the responsibility of presenting workable solutions at the Spring Conference.

Merchandising aspects of the electrical industry were apparent in all sections and divisions represented at the recent conference — engineering, accounting and commercial. A comprehensive report by H. T. Rankin, chairman of the sales and promotion division, indicated how completely the marketing of appliances and other electrical equipment in the postwar period will infiltrate planning considerations of other groups within the industry.

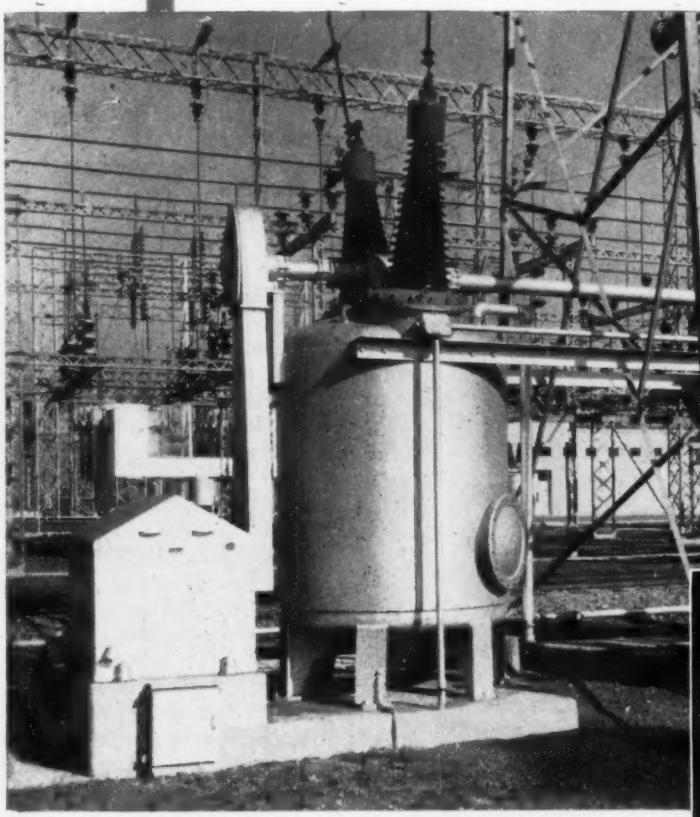
Data presented by F. F. McCammon, Public Service Co. of Colorado, disclosed that the government is now actively engaged in plans contemplating some 270 power, irrigation and flood control projects for peacetime. These enterprises apparently are enjoying the benediction of The Department of Interior, with the Bureau of Reclamation having little or no part in them.

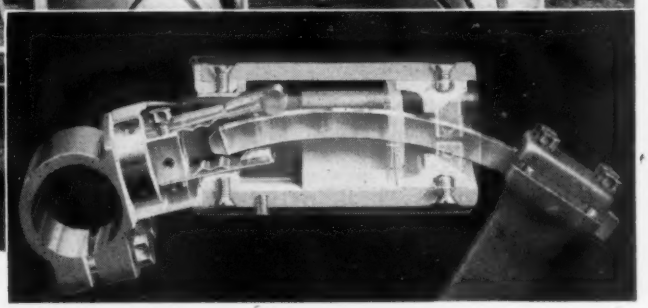
Contractors Elect

Los Angeles Chapter, National Electrical Contractors Assn., re-elected A. L. Stone as its president at the annual meetings of the chapter and of its executive committee, Feb. 16 and 22, respectively. The executive committee was elected at the annual chapter members meeting, Feb. 16. It consists of Richard E. Arbogast, Newbery Electric Corp.; R. F. Doll, Mactolf-Doll Electric Co., Glendale; C. D. Draucker, C. D. Draucker Electric Co.; R. M. Fry, R. M. Fry Electric Co., Hollywood; Sid F. Hill, Hill Electric Co.; R. R. Jones, R. R. Jones Electric Co., South Pasadena; Howard L. Stolper, Stolper Electric Co., Burbank; A. L. Stone, Stone Electric Supply Co.; and Harry R. Vancott, Vancott Co. At the Feb. 22 meeting of the executive committee, A. L. Stone was elected president, R. E. Arbogast, vice-president and Warren Pen, secretary-treasurer.

● A REFRESHER course on Illumination Fundamentals is being started by the lighting forum committee of the Rocky Mountain Chapter, Illuminating Engineering Society. The course is a twelve-lesson series titled *Light and Sight* and will be held at 211 Gas & Electric Bldg., Denver, Colo.

Improve Old Breakers..





Cross-section view of famous Pacific Electric Expulsion Contact as used in improving the interrupting ability and reducing maintenance of the 115-kv. breaker pictured above. ➔

for MORE PROTECTION of WAR LOADS

HOW TO CLEAR FAULTS FASTER, IMPROVE INTERRUPTING ABILITY WITH *PACIFIC ELECTRIC* EXPULSION CONTACTS

Older Pacific Electric Breakers can be quickly modernized by the application of P.E. Expulsion Contacts — an exclusive feature of the modern P.E. Breakers which are nationally known for fast arc clearance, improved interrupting ability and lower maintenance.

By the addition of the Expulsion Contacts to older breakers your breakers will protect heavier loads at less maintenance.

With the resulting shorter tripping time, contacts last longer and oil carbonization is greatly reduced.

Ask us about the application of the P.E. Expulsion Contacts for improving the interrupting ability of older P. E. Breakers. Full details about this money-saving, time-saving, critical-material saving protection of war loads are available. All you need do now is tell us the number of Pacific Electric Breakers you consider improving, giving their sizes and serial numbers.

C. H. Cutter
1015 Securities Bldg.
Seattle, 1, Wash.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, 13, Calif.

J. E. Redmond
448 W. Madison St.
Phoenix, Ariz.

Myron Swendsen
P.O. Box 156
Boise, Idaho

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

Wholesalers to Meet

War conference scheduled at Santa Barbara in May

INSTEAD of prewar customary two meetings a year, Pacific Division, National Electrical Wholesalers Assn., will hold one single war conference at the Santa Barbara Biltmore Hotel, Santa Barbara, May 22 to 24, it was announced by H. E. Perl, State Electric Supply Co., Oakland, chairman, and R. A. Balzari, secretary. Charles Pyle, managing director of NEWA, and some other national figures are to be on the program. The entire agenda will be centered about wartime problems of electrical wholesalers in the materials, manpower, and regulations fields. Another topic probably will be that of surplus government material disposal after the war.

Because of wartime conditions, members intending to attend have been asked by the secretary to make hotel reservations directly through the secretary's office more than 30 days prior to the meeting. Railroad reservations, likewise, should be obtained early, the secretary advises.

Distributors of appliances will now be eligible for membership in the NEWA. A special committee has been charged with the responsibility of developing a plan for inviting and admitting wholesalers who distribute for resale refrigerators and other electrical refrigeration equipment, electric heating and cooking units, all socket appliances, including radios and phonographs, all electric farm equipment, and radio wholesalers. They are to be admitted as special members at NEWA's annual convention in Chicago April 19 to 22. There will be created a special electrical appliance distributors' division with representation on the executive committee.

Heads EMEA Chapter

Julian H. Davis, consulting electrical and mechanical engineer, was elected president of the Electrical Maintenance Engineers Assn. of Southern California at its annual meeting in late January. William H. Carter, General Petroleum Co., is the new vice-president. Nels E. Swanson was re-elected secretary-treasurer. D. H. Byl, of Union Ice Co., and Henry Bush, of Littlejohn-Reuland Corp., were elected as members of the executive committee. Walter A. Smoker, Lockheed Aircraft Co., the retiring president, was given a leather traveling case as a token of appreciation by the members. Dr. Robert E. Vivian, dean of engineering, University of Southern California, discussed

DAVIS

Postwar Employment, and a question and answer session followed.—Henry Bush, editorial committee chairman.

Inspectors Plan Sessions

Three electrical inspectors' meetings have been scheduled within a week in the Mountain region for the week of April 10 so that the major speakers may appear on all three programs. The Rocky Mountain Chapter, International Association of Electrical Inspectors will meet first in Denver, April 10-11 coincident with other industry meetings of the Rocky Mountain Electrical League and the Rocky Mountain Chapter of Illuminating Engineering Society.

Next will come the Utah Chapter annual meeting at Salt Lake City on April 12. This will be followed by the Montana Chapter annual gathering at Great Falls, on April 14-15.

Victor Tousley, IAEI secretary, and several other prominent speakers are being scheduled for all three meetings which will be concerned with wartime inspection and materials difficulties and the need for anticipating and preparing for exceptionally difficult postwar situations in respect to materials, codes and training of electricians. Further details will be announced next issue.

The Thermal Aspects of Lighting was the subject for the Feb. 24 meeting of the San Francisco Bay Cities Section, Illuminating Engineering Society. The meeting was held in the Engineering Bldg., University of California campus, Berkeley, Prof. L. M. K. Boelter, department of engineering, was in charge and had speakers from his department. Demonstration was given of a portable radiometer, portable heat meter, low-level brightness meter, spectrophotometer, liquid filters and the shape factor integrator. The practical problems of heating and ventilating as affected by lighting systems was discussed by Prof. B. F. Raber, chairman of the department of mechanical engineering. Romaine W. Myers, chairman of the section, presided.

E. I. Wire Reviewed

Wires with emergency insulation were thoroughly reviewed and discussed at the last meeting of Southern California Chapter, International Association of Electrical Inspectors in Los Angeles. But before the meeting ended the group passed a resolution which indicated that emergency insulated wire is proving unsatisfactory. The resolution asks that, as soon as synthetic rubber is available in sufficient quantity for insulation of building wire, paper and other substitutes be abandoned. Wording of the resolution says:

"Field experience in the use of wire encased within this wartime insulation has proved that it is not a satisfactory substitute for rubber covering in that it breaks down under installation and does not provide a satisfactory degree of insulating safety. The resolution was addressed to the War Production Board through the IAEI executive committee and executive council. Furthermore, the resolution recommended that, as soon as word has been received from WPB that synthetic rubber is being released for wire manufacture, members will set a specific date after which they will accept no installations containing E.I. wire. That date would be such as to permit sufficient time for contractors and wholesalers in southern California to dispose of existing stocks of E.I. wire.

The chapter also appointed a postwar committee to function both as an advisory committee to the adequate wiring committee of the Pacific Coast Electrical Assn. and likewise to study questions relating to emergency substitutes, reinspection after the war, used equipment, surplus stocks of equipment placed on the market and effects on basic fundamentals of wiring.

H. C. Rice, manager, domestic sales, Southern California Edison Co., chairman of the adequate wiring committee of PCEA, discussed the home planning clinics, the first of which was held at Pomona and at which M. G. Riddle, chief building and electrical inspector, presented the necessity for wiring regulations. Fred Pohl, field engineer, National Electrical Products Co., discussed the various emergency wires and their uses according to the interim amendment to the code. I. E. Bartlett, city electrician, Inglewood, Calif., chairman of the chapter, presided over the meeting.

Utilization of manpower was the chief topic at the Northwest war production conference held in Seattle Feb. 3 at its civic auditorium. Among the topics covered was *Application of Electricity for Maximum Manpower Utilization*, handled by Harry Techlenburg, manager, plant facilities, Boeing Aircraft Co.

Highlights of Anaconda messages to the public

re: POSTWAR ELECTRICAL POSSIBILITIES

TIME

..."America's electrical future is limitless... with victory, expanded use of electric energy will affect everyone—industrialist, dealer, housewife—employment, prosperity, living."

BUSINESS WEEK

..."but this fact is all important: when you plan your electrical future, start with *wiring. Adequate* wiring will be essential to full utilization of tomorrow's electrical possibilities . . . and that applies to municipality or factory, business or home . . ."

NEWSWEEK

..."by all means, bring the power engineer from your local utility and your electrical contractor into your *advance* planning. *Unwired* planning will cost you a lot more than *planned* wiring!"

Anaconda Wire & Cable Company is devoting its current advertising to spreading public knowledge and appreciation of what the electrical industry means to the country and to postwar prosperity.

Obviously, adequate wiring will be essential. The wider the recognition of this, the better business for everyone... utility, contractor, wholesaler, manufacturer.

And now is the time to lay the foundation for tomorrow's electrical needs. More and better wiring should be a part of every postwar plan.

44220

ANACONDA

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation

NEWS of the industry

ARMY STEPS IN TO END LOS ANGELES STRIKE

Military operation of the Los Angeles Department of Water & Power ended at noon, Feb. 29, when Col. Rufus W. Putnam, Corps of Army Engineers, and his staff officers relinquished control. Meeting in executive session immediately after, the Board of Water and Power Commissioners instructed General Manager H. A. Van Norman to proceed at once with "an impartial and competent survey of wage and other employment relations matters" and to recommend to the board as soon as possible steps for bringing about a settlement of the controversy. As this issue went to press, further action of employees was undetermined.

At the request of Mayor Bowron, the Army on Feb. 23 took over operation of the Los Angeles Department of Water & Power, ending a 10-day strike of electrical workers which, combined with heavy wind and rain, had blacked out 125,000 homes and industrial plants, including 160 small war plants.

Some 2,500 employees who had joined the AFL-called strike voted to return to work immediately and no troops were needed to repair damage and put back in service the 54 feeders affected by the storm, one of the heaviest in recent years. Essential service had been maintained until the storm by a skeleton crew.

The strike was called by the AFL International Brotherhood of Electrical Workers when the city refused to meet wage demands, but strong political implications were seen in the controversy.

Picketing strikers carried banners bearing such phrases as: "Are Bowron Commissioners Out To Sabotage Public Ownership in Los Angeles?" The mayor charged that his political opponents in the department of water and power may have inspired the strike. Recent appointment of Joseph Jensen to the Water and Power Commission had been bitterly opposed by a strongly organized political group within the department.

Strikers asked an eight per cent wage increase, retroactive to last Sept. 1, or a flat $15 monthly increase for all employees receiving up to $350 a month and payment of prevailing wage scales to all workers employed on an hourly or daily basis. A $5 a month increase offered by the department was refused.

Mayor Bowron pointed out that the $5 increase would have brought to $20 a month the amount employees' salaries have been boosted during the past 17 months and that the strikers were already receiving a wage scale higher than that paid by private utilities for comparable work.

Before the Army moved in, the Tenth Regional War Labor Board had issued a demand to H. A. Van Norman, manager of the department, and to union officials that they arbitrate their dispute. Bowron had declared that the city would not treat with the strikers until they had returned to their jobs. Strikers had refused to go back to work until their demands were met.

Earlier offers of federal agencies to aid with negotiations had been refused by the city as unnecessary. Strike leaders, however, had appealed to President Roosevelt to appoint a federal referee in the controversy.

Tucson Voters Approve Take-Over of Utility Properties

Residents of Tucson, Ariz., voted Feb. 25 in favor of acquiring the properties of the Tucson Gas, Electric Light and Power Co., but a second election will be required in order that the voters may express their sentiment relative to a bond issue with which to finance purchase of the utility's holdings. Voters turned down a proposal to acquire the properties last October.

Two condemnation suits against the utility are pending in federal court, one brought by the City of Tucson and the other by the suburb of South Tucson, where voters recently authorized a $9,500,000 bond issue for a take over of company properties.

Also pending is the SEC case to determine the status of the Federal Light and Traction Co., parent company of the Tucson utility. Consolidation of Federal's holdings in Arizona, Colorado and New Mexico is being considered by the SEC.

● RIGHTS of shareholders in assets of San Joaquin Light & Power Corp. will be determined in a hearing set for Mar. 15 in Fresno, Calif. The hearing is a step in the voluntary dissolution of the corporation. Transfer of assets to Pacific Gas and Electric Co. has been authorized by the California State Railroad Commission.

PUDS MAKE BID FOR PUGET SOUND HOLDINGS

With Bonneville Administrator Paul J. Raver acting as its agent, a combine of 16 PUDs will offer $33,000,000 for Puget Sound Power & Light Co. distribution properties in 19 western Washington counties, it was announced late last month by A. G. Ziebell, chairman of the allied PUD negotiating committee. Major generation and transmission facilities will not be included in the offer, it was stated.

Although the City of Seattle will join with the PUDs in system-wide negotiations for the private utility's distribution facilities, the price which it will offer for properties within the city has not been set.

E. L. Manson, of the Chicago engineering firm of Jay Samuel Hart & Associates, made the recommendations on which the $33,000,000 bid is based. If negotiations are successful, the purchase will be financed by revenue bonds issued by the districts.

Stating that the power company had received no purchase proposal from any agency legally qualified and financially able to acquire the company properties, Frank McLaughlin, president of Puget Sound, pointed out that at the present time "agitation and political activity calling for an upset of the power situation in a large section of the state and asking for the elimination of a large tax-paying enterprise cannot do otherwise than invite chaos, promote disunity and hamper the war effort."

"The company has maintained . . . that it will give earnest consideration to any fair proposal for the acquisition of its electric properties as an entirety, if presented by an agency giving proof that it has the legal power to acquire such properties and also the ability to finance such acquisition," he continued.

"All I know about the present doings is what I see by the papers. But, as I understand it, the Bonneville program contemplates that agency acquiring the bulk—if not all—of the company's generation and transmission facilities.

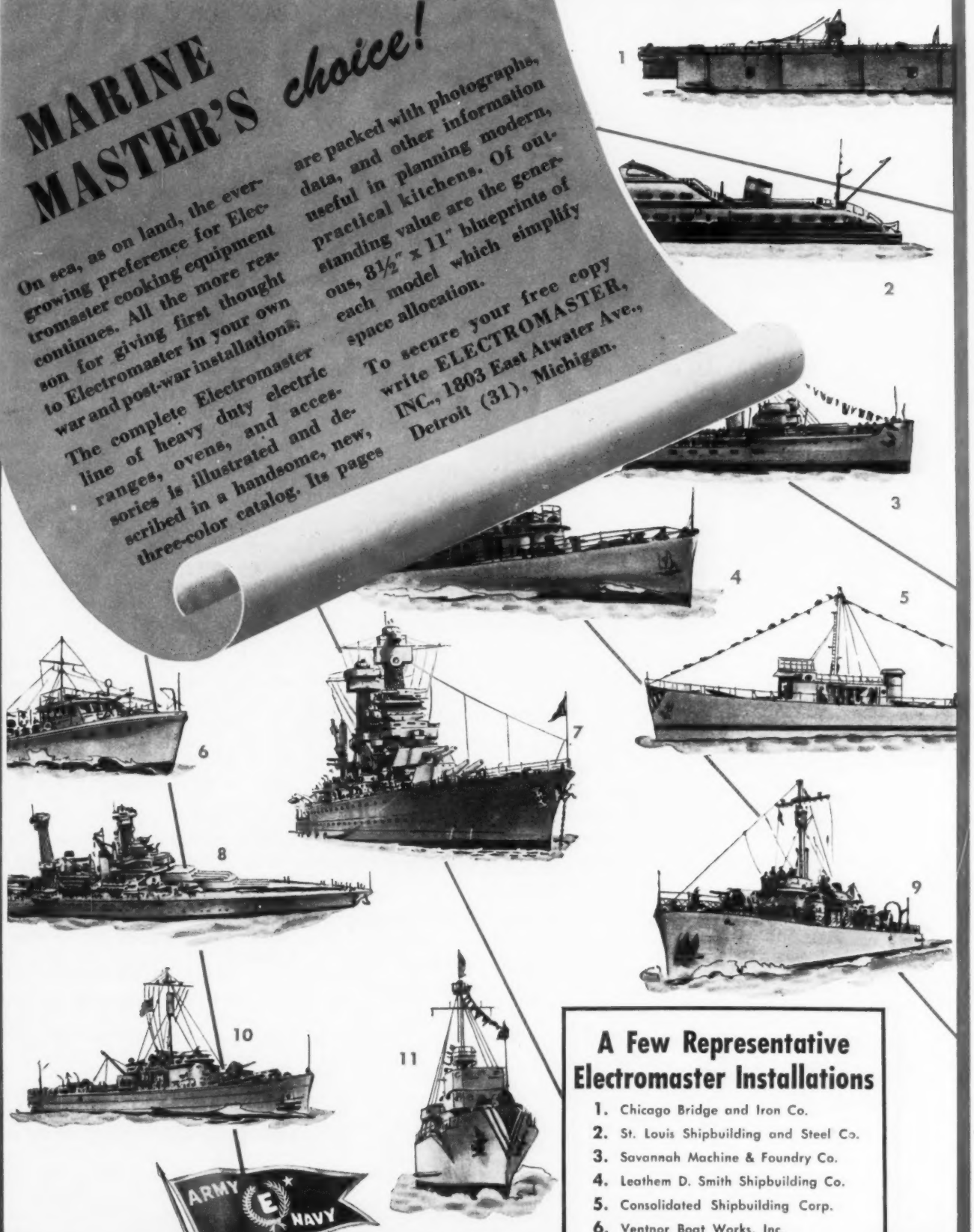
"Before any valid proposal on such basis could be made . . ., it would seem as though it would be necessary for Bonneville to obtain authority from Congress which would enable it to acquire the company's generation facilities, as the present act and the appropriations therewith do not contemplate any such acquisition."

MARINE MASTER'S *choice!*

On sea, as on land, the ever-growing preference for Electromaster cooking equipment continues. All the more reason for giving first thought to Electromaster in your own war and post-war installations.

The complete Electromaster line of heavy duty electric ranges, ovens, and accessories is illustrated and described in a handsome, new, three-color catalog. Its pages are packed with photographs, data, and other information useful in planning modern, practical kitchens. Of outstanding value are the generous, 8½" x 11" blueprints of each model which simplify space allocation.

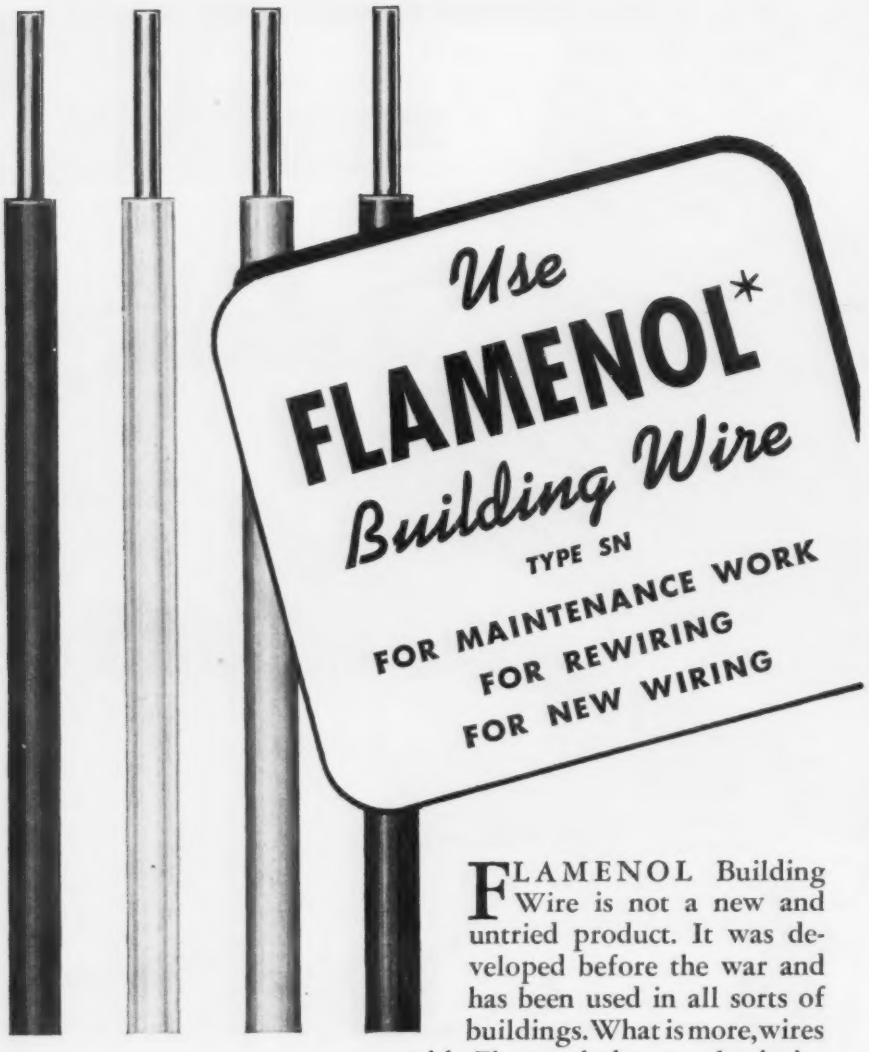
To secure your free copy write ELECTROMASTER, INC., 1803 East Atwater Ave., Detroit (31), Michigan.



A Few Representative Electromaster Installations

1. Chicago Bridge and Iron Co.
2. St. Louis Shipbuilding and Steel Co.
3. Savannah Machine & Foundry Co.
4. Leathem D. Smith Shipbuilding Co.
5. Consolidated Shipbuilding Corp.
6. Ventnor Boat Works, Inc.
7. U.S.S. West Virginia (BB48)
8. U.S.S. California (BB44)
9. Luders Marine Construction Co.
10. Albina Engine & Machine Works
11. Pullman-Standard Car Mfg. Co.

ELECTROMASTER INC.



FLAMENOL Building Wire is not a new and untried product. It was developed before the war and has been used in all sorts of buildings. What is more, wires with Flamenol thermo-plastic insulation have been used for a much longer time — switchboard wire, wire for signal circuits, machine tools, etc. It is approved by the Underwriters'.

Flamenol Building Wire is available now in sizes 14 to 1,000,000 CM. (Resins are permitted for electrical conductor insulation wherever copper is allocated.) Use this wire for the war-purpose jobs you are handling. It is easy to use and will give long service.

For further information see the nearest G-E Merchandise Distributor or write to Section W-341-18, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

Look at the Features

1. Small in diameter — Saves space.
2. Superaging—Long life, no oxidation
3. Easy pulling — Hard, smooth finish
4. Heat resistant — Rated 60 deg. C.
5. Free stripping — Speeds splicing and soldering
6. High dielectric strength—720 volts per mil, test result
7. Flame proof — Will not support combustion
8. Insulation — Tensile strength of 2000 lb. per sq. in., test result
9. Many colors—Same range as Type R wires
10. Oilproof — Unaffected by oils, water, acids, alkalies
11. Attractive — Retain fine appearance
12. Self-protecting—No braid necessary

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC

ARIZONA RATIFIES COLORADO COMPACT

Ending a 22-year controversy, Governor Sidney P. Osborn of Arizona on Feb. 24 signed the Colorado Compact, alloting the waters of the Colorado River and its tributaries to the seven basin states.

His action followed announcement on Feb. 10 by Interior Secretary Harold L. Ickes that he had signed a contract on behalf of the federal government, agreeing to deliver to Arizona the specified amount of water from the Boulder Dam reservoir, and formal ratification by the Arizona State Legislature on Feb. 16.

The contract grants Arizona 2,800,000 acre-ft. of water annually from storage in Lake Mead, Boulder Dam reservoir, provided it is available under the terms of the Colorado River Compact and the Boulder Canyon Project Act. It also allots to the state half of any surplus unapportioned by the compact.

With California dissenting, the Committee of Fourteen, composed of two representatives of each of the seven Colorado River states, approved the contract. California objected on the grounds that the quantity of water specified cannot be delivered to Arizona by the USBR without invading the water supplies rightfully belonging to herself and other basin states.

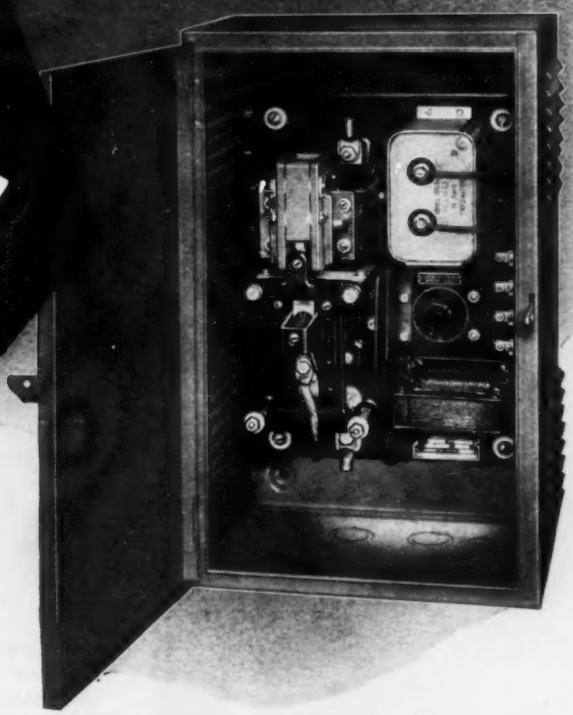
Under the Colorado Compact, which Arizona hitherto has refused to sign, the waters of the river were apportioned between the states of the upper and lower basins, each group being granted 7,500,000 acre-ft. of water annually. In addition the lower basin was given the right to increase its use by 1,000,000 acre-ft. per year. The Boulder Canyon Project Act, passed by Congress in 1928, carried the provision that it should not become effective until California agreed to limit its use to 4,400,000 acre-ft. of the water apportioned by the Compact, plus one-half of the surplus water. The California legislature passed such an agreement in 1929.

● PACIFIC GAS AND ELECTRIC CO. petition for a rehearing on a decision upholding an SEC ruling that the company is a subsidiary of North American Co. was denied last month by the Ninth Circuit Court of Appeals. The decision on Nov. 18, 1943 was by an equally divided court.

● INVESTIGATION of the California Electric Power Co.'s rates, charges, and rules will be conducted by the Californa Railroad Commission upon its own motion. No date has been announced for the hearing.

FOR HIGHER RATINGS AND LONGER CONTACT LIFE

SQUARE D SYNCRO-BREAK RESISTANCE WELDER CONTACTORS



Arcing is eliminated at the contact tips of *SYNCRO-BREAK* contactors by separately energizing the magnet "shading coil" from a transformer and rheostat circuit. Correct rheostat adjustment causes the contacts to part as the alternating current wave approaches zero. Thus, the contactor interrupts zero current and no arc is drawn.

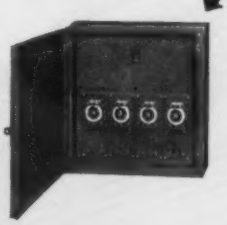
Elimination of arc heat at contacts increases allowable ratings and contact tip deterioration is reduced substantially. Rheostat adjustment is not critical and synchronization remains stable over long periods of usage.

Among the important mechanical design features which assure long, trouble-free service are: Hardened, knife-edge bearings for long life without lubrication. Solid contact supports to conduct away heat and relieve contact studs from impact strain. Low inertia moving parts and short contact gap, permitting consistent high-speed operation.

FOR FULLY AUTOMATIC CONTROL OF RESISTANCE WELDING MACHINES

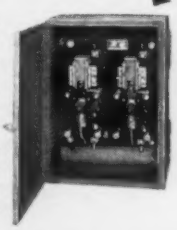
Use Safront Weld or Sequence Timers with SYNCRO-BREAK Contactors or HIGH-SPEED Contactors

Available in 18 NEMA standard types with separate pneumatic timing relays for each step of the welding cycle. All electrically energized parts are placed behind a protective panel. Calibrated timer dials are adjusted from the front.



Notice attractive new flat-door cabinet construction which harmonizes with Safront timers. This design allows more interior wiring space without increasing overall outside dimensions. Syncro-Break contactors are single pole only.

Available in either single or double pole, employing the same contactor construction as the Syncro-Break. High-Speed contactors without the synchronizing circuits are applied where operation is less frequent and loads are lighter.



ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

LOS ANGELES 21 • SAN FRANCISCO 3 • DENVER 4 • DETROIT 11 • MILWAUKEE 2

NOW IS THE TIME TO SELL POSTWAR LOADS

YOUR ELECTRIC COMPANY is interested in postwar loads from industry, from the mining field, from building construction and highway lighting and you will want to know that Roebling is helping to pave the way for you.

Advertising of Roebling Electrical Wires and Cables for 1944 in all of these fields is dedicated to electrical modernization. It is telling industry what electricity can do in cutting postwar costs with better lighting, air conditioning, electrical and electronic control. Reminding the mining and construction fields that electrical modernization can bring them benefits too.

. . "Your Local Lighting Company's Engineer"

All of this advertising refers its readers directly to the engineers of their local electric companies, for help in planning for fullest postwar use of electricity. We hope that it may help, when the day comes that load-building becomes a problem again.

Electrical Wire and Cable Division

JOHN A. ROEBLING'S SONS COMPANY OF CALIFORNIA

San Francisco • Los Angeles • Seattle • Portland

ROEBLING

PACEMAKER IN WIRE PRODUCTS

WIRE ROPE AND STRAND • FITTINGS • SUSPENSION BRIDGES AND CABLES HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • ROUND AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • COLD ROLLED STRIP WIRE CLOTH AND NETTING • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES AERIAL WIRE ROPE SYSTEMS

Highways will "Go Electric"
Tomorrow's Mines will
MODERNIZE
How Many EYES on Your Payroll?
How Your Local Utility's Engineer Can Help You Cut Postwar Costs

Disposal of Government Inventories

How to dispose of government surpluses when the war ends need not be an insuperable problem – if we face it promptly and intelligently. But if we do not, peacetime markets may be disrupted, government funds wasted, production discouraged, and reconversion of the whole economy to peace seriously hampered.

What we need most in order to attack the problem is estimates of how much surplus there will be, in what types of goods, and where.

At the war's end, government inventory of war goods is likely to total around 60 billion dollars. Most of this will consist of aircraft, ships, and other ordnance. Only some 15 billion dollars or less will be in food, clothing, trucks, tools, chemicals, medical supplies, transportation, engineering and communication equipment, and other goods for which there is a civilian market.

In addition, war contractors will have about 10 billion dollars of inventories, the bulk in specialized raw materials, goods in process, and finished products. Only about one-fifth of the total, or some 2 billion dollars, will be marketable or usable for civilian purposes. While the government takes over the usable inventory, the ex-war-contractors will have to build up their stocks for peacetime production, so that on balance, they will not be disposing of usable inventories in large volume.

Not even all of the usable war-end inventory will be "surplus" for sale to civilians in competition with new production. Some of it will be needed by the sizable peacetime Army and Navy we are likely to maintain, and such additional items as can be stored without serious deterioration or obsolescence will be held against possible future war emergencies. Some of it will be disposed of abroad. And up to half of it will be abroad and may be sold there or used for relief.

After allowing for these factors, the war supplies to be disposed of in our own markets probably will be less than 10 billion dollars (cost basis). While the total is not overwhelming – the equivalent of two months' retail sales – in certain lines the surplus will be several years', instead of a few months', normal supply. In particular, the volume of scrap metals available from otherwise unusable munitions will present a problem.

A great deal can be done now to reduce the size of the postwar surpluses by achieving a better balance between military needs and supplies and avoiding excessive inventories of particular raw materials or finished goods. This work needs to be pressed, not only to simplify our transition to peace but also to prevent wasting productive energies during the war. Furthermore, when the war ends on one front, inventories of war materiel should be worked down to the reduced scale of remaining military activity.

We cannot develop programs of action until we know approximately how much of each type of item is to be sold, and where and when it will be available. Wide margins of error are inevitable as long as large-scale procurement and large-scale consumption are still taking place; yet such information is essential and must be developed. Indeed, improved inventory records and estimates are badly needed for the conduct of the war as well as for managing the surpluses after hostilities cease.

In decisions on the disposal of war-goods inventories, the public interest must be the prime consideration. Proposals that none of these goods should be sold domestically because of competition with new production obviously are untenable. Everything that is not needed by the Armed Services or for other special purposes should be disposed of ultimately. The real problem is not whether surpluses should be sold, but rather to whom, at what price, and at what time the sale should be effected.

In the distribution of such large quantities of goods, we believe that established trade channels should be used wherever possible. Otherwise, we shall witness widespread speculation in war goods and the mushroom growth of inefficient and disruptive fly-by-night distributors. This will benefit only a few speculators and will discourage legitimate producers and distributors from making their normal commitments.

All war contractors should have the privilege of retaining those inventories for which they are willing to pay actual cost or a fair price negotiated with the gov-

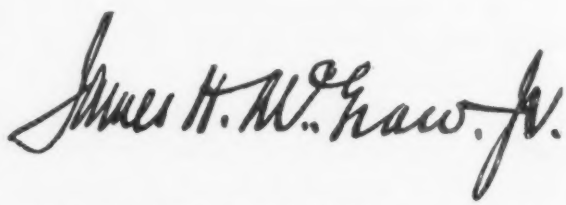
ernment procurement agency. The balance of the inventories in the hands of war producers should be assembled by the government and sold in an organized manner. It is of great importance that the plants be cleared of these inventories at once so that the process of conversion to peacetime operation can proceed without further delay. To accomplish this, preparations must be made before the end of the war for speedy determination of the inventories to be moved and for a huge volume of storage space to accommodate them.

The price which can be realized and the timing of sale are closely related. Certainly the best prices will not be secured if the government attempts to dispose of large supplies of material and products suddenly without regard to market conditions. Most businessmen rightly favor an early transfer of surplus inventories from government to private ownership. But, they also realize that if all the surpluses are dumped indiscriminately as they become available, many markets will be badly depressed, and the resulting low prices will bring lower production. If this depression effect becomes general, as it easily can, it will be costly to the nation in terms of jobs, income, and goods.

In industries in which production is inadequate to meet postwar demands, an immediate sale of government inventories can prevent inflated prices and preserve balanced market conditions. In cases in which the surpluses are large in relation to annual production, the disposition can be scheduled over a period of years. Generally, however, it will be best to clear the surpluses as quickly as orderly sale can be accomplished rather than to leave them as a continuing threat overhanging the market. Most industries can, and should, take the disposal process in their stride without special dispensations from the government. In this connection, it should be noted that the tax provisions for carry-back of losses and excess profit credits after the war greatly increase the possibilities for speedy disposal of surpluses without serious injury to producers.

There will be some industries, however, in which the postwar surplus is so large that it would practically saturate the market for years to come. The problem of these industries is further complicated by their wartime expansion of capacity many fold in excess of peacetime requirements. These lines of production are, moreover, crucial for our national defense. Aircraft and shipbuilding are cases in point. Each of these situations calls for careful study and discussion by all concerned to devise means to keep alive the necessary production organizations, the research effort, and the spirit of enterprise. Insofar as possible, the individual manufacturers should work out their own salvation in the conversion to peacetime markets. They can do this by taking on new lines, by increasing their production efficiency, and by developing technical improvements which make the existing inventories obsolete. But they still will need some kind of government protection or assistance while the huge surpluses are being worked off. It is most important, however, that such protection or subsidy be limited to a period of three to five years. It must not become permanent unless it is really essential for our national security.

The disposal of surplus inventories is part of the whole process of demobilization of the war effort and conversion to peace. If this process is to be accomplished with minimum dislocation and injury to our economy, it will have to be directed by a central agency which has developed adequate information service and is in position to coordinate the policies of the Armed Services and the other interested executive branches of the government. This agency should draw freely on the knowledge of businessmen in the specialized problems of marketing surpluses in each industry. It should formulate definite programs of inventory disposal for all industries in which the problem is acute; and it should make these programs public as soon as possible, so that business can plan for the future with confidence. In large measure, the success with which we make the economic transition to peace will depend on the quality of government administration in the process of industrial demobilization. We shall need better organization for the transition to peace than we had in mobilization for war if we are to avoid needless unemployment, loss of production, and frustration of business enterprise.



President, McGraw-Hill Publishing Company, Inc.

FRIGIDAIRE'S

New Enlarged Dealer Program for 1944

To help dealers build good will with future prospects; maintain their Frigidaire identity; and keep essential equipment in operation

NEW "HOW TO DO IT" ADS IN WOMEN'S MAGAZINES
30 MINUTE SOUND MOVIE FOR GROUP USE
NEW FROZEN FOOD PACKAGING KIT AND HELPFUL INSTRUCTIONS
NEW "DEPENDABILITY" ADS IN NATIONAL WEEKLIES
NEW HELP TO SERVICING DEALERS
NEW BOOKLETS TO HELP USERS
Frozen Food Packaging Kit
Conservation Tips
101 Refrigerator Helps

NEW ADVERTISING is addressed to millions of postwar prospects for electric refrigerators, ranges, water heaters, commercial refrigeration and air conditioning equipment.

Continuing last year's successful campaign, a new series of "down-to-earth" Frigidaire messages in women's magazines, newspaper supplements, key city newspapers, farm and small town publications will offer refrigerator users timely, practical help with wartime food and refrigeration problems.

Additional advertising in a long list of national weeklies and business papers will stress the dependability of Frigidaire products; and register with readers that the name "Frigidaire" on a refrigerator, range, or on *any* equipment is a dependable guarantee of user satisfaction.

NEW AID will be offered home economists, teachers and group leaders in their own publications. These aids include specialized information on timely refrigeration subjects; helpful, informative booklets; and the popular sound movie "How to Get the Most Out of Your Refrigerator."

2 NEW FREE BOOKLETS will be provided for Frigidaire dealers to help them maintain contacts with Frigidaire users and to capitalize on national advertising!

One is a companion booklet to Wartime Suggestions, 6¾ million copies of which were distributed in 1943—5¾ million by Frigidaire Dealers! It will be larger, more colorful; will contain new, more detailed information on refrigerator care and use. Another new booklet will help users of commercial and air conditioning equipment solve *their* wartime care and maintenance problems.

NEW WRAPPING MATERIALS will help the Frigidaire Dealer identify himself with the important Home Freezer business. A new, unique Frozen Food Packaging kit, distributed through Dealers, will provide an important service to Frigidaire Home Freezer users. It includes quantities of approved wrapping materials; complete packaging instructions; and a helpful Inventory Record Book. These materials supplement the recently released Home Freezer booklet that gives Frigidaire users complete instructions on the preparation, wrapping and storage of foods for home freezing.

NEW AID FOR SERVICE DEALERS is the purpose of a comprehensive Frigidaire plan based on greatly expanded factory facilities for parts manufacture and parts distribution; help with vital manpower problems. Training materials for beginners and veterans are unique, practical. A new "preventive service" program helps make fullest use of available manpower.

BUILDING FOR THE FUTURE, Frigidaire is now developing a backlog of sales opportunities for *all* Frigidaire products that will benefit every Frigidaire Dealer when Victory is won.

Listen to **GENERAL MOTORS SYMPHONY OF THE AIR,** *Every Sunday Afternoon, NBC Network*

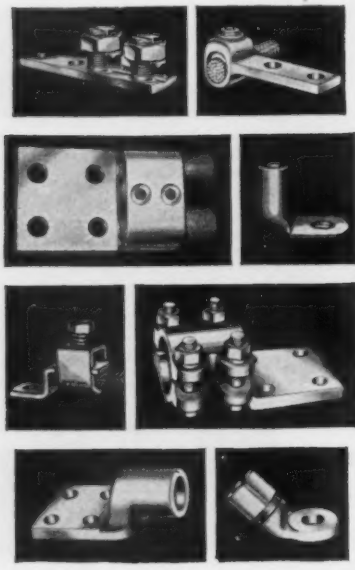
For Excellence in War Production

FRIGIDAIRE
Division of
GENERAL MOTORS
DAYTON 1, OHIO • LEASIDE, ONTARIO
Peacetime builders of
ELECTRIC REFRIGERATORS • RANGES • WATER HEATERS
HOME FREEZERS • ICE CREAM CABINETS
COMMERCIAL REFRIGERATION • AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS

"To get the **RIGHT** lug at every point—

—select your terminals from the **COMPLETE** line"

Look in the Penn-Union Catalog —all of the good types: Solderless lugs to grip the conductor by Bolt, Screw, Post-and-Nut, or Multi-Slit Tapered Sleeve . . . Soldering lugs, Cast and Stamped, in wide variety . . . Here are just a few:



You will also find the most complete line of Cable Taps, Tee Connectors . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Service Connectors.

F. M. NICHOLAS CO.
1123 Harrison St., San Francisco

KENNETH ANDERSON CO.
334 East 4th St., Los Angeles

NORTHWESTERN AGENCIES
2411 First Ave., Seattle, Washington

Penn-Union Electric Corp., Erie, Pa.

PENN-UNION
Conductor Fittings

OPA ENTERS LONG-PENDING UTAH RATE CONTROVERSY

OPA last month entered the controversy surrounding the Utah Power & Light Co. rate case, when it asked and received state supreme court permission to intervene as amicus curiae. OPA brief was to be filed on Feb. 15, date on which the public service commission was to submit its brief on the utility's appeal from the $1,500,000 annual rate cut ordered last September.

The federal agency gave as its reason for upholding the commission order its relation to the nation-wide price stabilization program, stating that reversal would impair OPA efforts to secure utility rate reductions. Desire of the agency to get its position before the court in a brief rather than to become a party to the suit by intervention was expressed by A. M. Ferro, OPA attorney.

The commission, through its attorney, Clinton D. Vernon, said that it did not oppose the right of OPA to file a brief, but reserved the right to contest any position taken by OPA which might be inconsistent or based on a misinterpretation of the rate reduction order.

Replying to a statement by Paul H. Ray, Utah Power & Light Co. attorney, that the company is anxious that the case not be delayed and would object to extraneous matters being brought into the case at this time by OPA, Chief Justice James H. Wolfe said that the court also desired to expedite the case and would consider only argument as to why the position of the commission should be sustained. He stated that he hoped the case could be heard during the March term.

In a statement criticizing the OPA action, George M. Gadsby, utility president, pointed out that electricity is one of the few things sold at prewar prices without rationing and without change or deterioration in quality of service and that one of the results of the reduction would be to deprive the federal government of more than $1,500,000 per year in taxes and to dissipate it mostly in small individual reductions which are added to current spending power, thereby directly promoting inflation.

"We can see in this attempted action on the part of OPA the increasing desire of federal bureaucracy to encroach upon state functions," Gadsby stated. "If the federal bureaucracy is able to take over and interfere with the functions of state regulatory bodies, experience should teach that any control it grasps or authority it succeeds in obtaining will not be relinquished later, but the price paid will be a permanent surrender of one more of the state's rights. We have a state regulatory body adequately financed and able to employ such expert advice and assistance as it needs. If state government is to be maintained, these encroachments by federal bureaus should be resisted.

"The intervention comes at a late hour. The case has been pending before the state commission since Aug. 1942, almost a year and a half. The appeal from the commission's decision was taken to the supreme court last October, brief of the company was filed early in December and the brief of the commission, under the last extension granted by the court, is due Feb. 15.

"The outcome of this case is of great importance to the company and its preferred stockholders. Any delay occasioned by this late attempted intervention may be of serious effect."

New Developments in Portland Rate Case

Portland General Electric Co.'s petition for an injunction against the recent rate reduction order of Public Utilities Commissioner George H. Flagg was heard in the Marion County (Ore.) circuit court on Feb. 10.

To charges that his emergency order was issued without formal hearing or notice to the company, Flagg replied that the order was preceded by a long series of negotiations with PGE officials and an agreement was almost reached when negotiations broke down. He did not believe a hearing was required in the situation that existed, he stated.

PGE attorneys and Rex Kimmel, appearing for the attorney general, were ordered by the court to file briefs by March 21. Ralph King, of the PEP Independent Trustees, will be permitted to enter a brief as a friend of of the court, it was ruled.

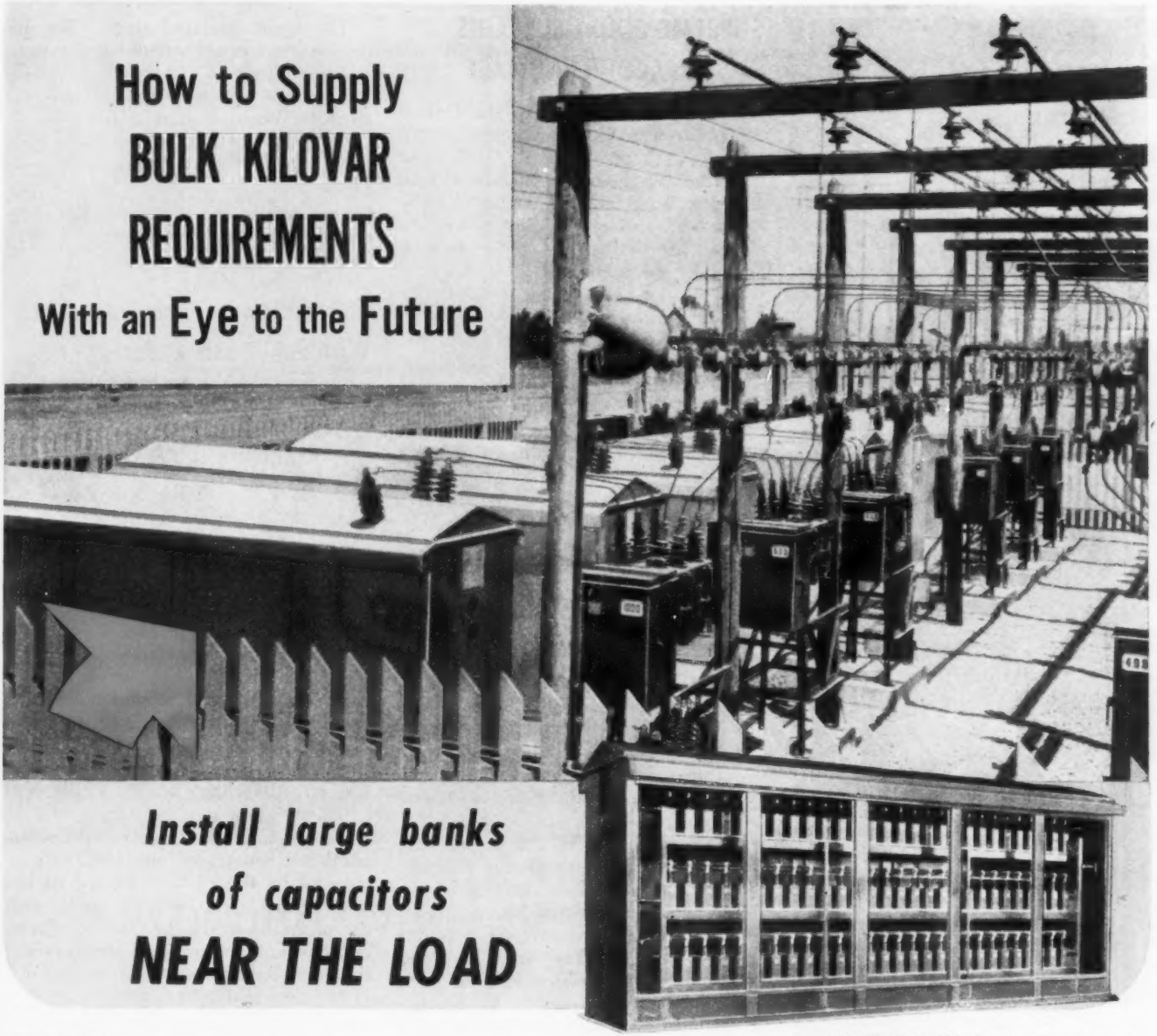
Rate Reductions Bring Savings At Seattle

Rate reductions will be put into effect by Seattle City Light and Puget Sound Power & Light Co. on April 1.

The city cut will bring annual savings to residential and commercial customers totaling $300,000. The Puget Sound reduction, which applies throughout the system, totals $700,000 annually.

The new schedules of both city and private utility lower the top step for residential and commercial power and lighting, schools, halls and churches from 3.5 to 3.2c per kilowatt-hour.

How to Supply BULK KILOVAR REQUIREMENTS With an Eye to the Future



Install large banks of capacitors NEAR THE LOAD

IN THE past two years a quarter of a million kva of large banks of Pyranol* capacitors have been installed *near the load* to meet wartime demands for large blocks of reactive kva. Why *near the load?* Because it has been found that, when the reactive requirement is supplied by distant generators, it is not uncommon for approximately one-third of the kilovars to be consumed in transit by the I^2X required by the conductors and transformers—not to mention the I^2R losses caused at the same time.

Capacitors are an ideal reactive source for several reasons. Their ready availability means that they can be obtained and installed in a matter of weeks. Their installed cost is well under $10 per kva. Relatively little critical material is needed in their manufacture as well as in their installation, compared with that required for additional circuit facilities.

A fact that adds immeasurably to the useful life of your investment is that, if future changes in system or load eliminate the need for the large bank, the capacitor units can be used later in smaller groups. G-E rack-type Pyranol capacitor equipments (for either outdoor or indoor installation) are ideal for this purpose.

SUPPLYING KILOVARS at a light-metals plant in the West—Pyranol capacitor equipments totaling 25,200 kva. Inset is a typical 2520-kva equipment, opened at the side to show 15-kva capacitor units and fuses.

Ask your G-E representative to estimate the benefits of large Pyranol capacitor banks on your system, or write for GEA-2746B. *General Electric, Schenectady, N.Y.*

*Reg. U. S. Pat. Off.

Every week 192,000 G-E employees purchase more than a million dollars' worth of WAR BONDS

GENERAL ELECTRIC

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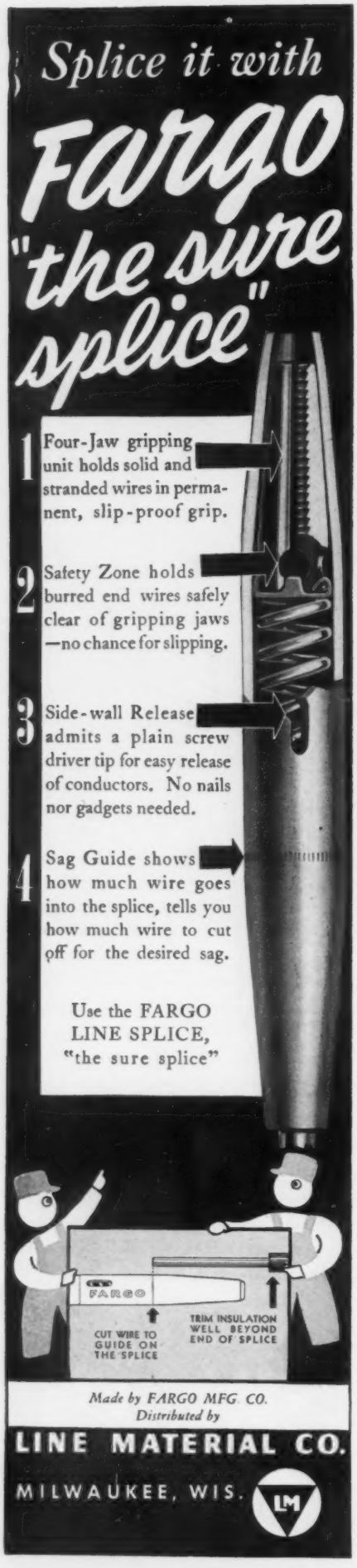
PYRANOL CAPACITORS


Splice it with
Fargo
"the sure splice"
1 Four-Jaw gripping unit holds solid and stranded wires in permanent, slip-proof grip.
2 Safety Zone holds burred end wires safely clear of gripping jaws —no chance for slipping.
3 Side-wall Release admits a plain screw driver tip for easy release of conductors. No nails nor gadgets needed.
4 Sag Guide shows how much wire goes into the splice, tells you how much wire to cut off for the desired sag.
Use the FARGO LINE SPLICE, "the sure splice"
FARGO
CUT WIRE TO GUIDE ON THE SPLICE
TRIM INSULATION WELL BEYOND END OF SPLICE
Made by FARGO MFG. CO.
Distributed by
LINE MATERIAL CO.
MILWAUKEE, WIS.
LM

SUPREME COURT SUSTAINS FPC IN ACCOUNTING CASE

By unanimous decision, the United States Supreme Court in February upheld FPC in its order of April 1942 directing Northwestern Electric Co. to amortize a $3,500,000 common stock "write-up" and prescribing procedure for so doing. This was the first such ruling by the high court.

Disposition of the write-up under the commission order was by application of net income after preferred dividends. In appealing to the supreme court, Northwestern and its parent, American Power & Light Co., pleaded that the order was invalid because it exceeded the commission's statutory authority and was in violation of the "due process" and "states rights" amendments to the Constitution.

Following its original order in December 1940, the commission granted a rehearing on the disposition clause only, but the company declined to offer alternative suggestions for removal of the write-up. While the disposition was under review, the Ninth Circuit Court upheld the order without ruling on disposition. The company later sought further review by the circuit court and, when that was denied, the case went to the high court on a writ of certiorari.

In upholding FPC, the high court declared that the commission's power to prescribe a uniform system of accounting and to require the company to keep accounts accordingly was not open to doubt. "The only inquiries now open," the decision said in part, "are whether the order as to the disposition of the $3,500,000 item . . . goes beyond the commission's statutory mandate or constitutional limitations. We hold that it does neither. . . . Although the commission's prescribed method of eliminating the write-up may not accord with the best accounting practice, it is sustained by expert evidence. It is not for us to determine what is better practice so long as the commission has not plainly adopted an obviously arbitrary plan . . ."

Holding that the Constitutional objections were without merit, the decision stated: "That the commission's action prevents the company from redressing the deficiency of paid-in capital by entering among its assets appreciation of value subsequent to the issue of the common stock takes nothing from the company or the stockholders. . . . Nothing in the statute or the order prevents Northwestern keeping other accounts if it so desires which will give information with regard to estimated present appreciated value of its assets . . ."

The court declared that: "We are not here concerned with what the regulatory authorities of Oregon or Washington may or may not demand or permit. Whatever that action may be, it is subordinate to Congress' appropriate exercise of the commerce power. The commission's order does not purport presently to affect or constrain action by the states within their fields."

Colorado Co-op Complies With Public Sale Order

Historic significance is attached to the recent compliance by the Empire Electric Assn. to the Colorado Public Utilities Commission's mandate that the cooperative (REA sponsored and financed) must amend its bylaws to permit sale of energy to the public, instead of restricting such sales to members only, as a requisite to purchase of the Highland Utilities properties in Montezuma County, Colo.

This is the first instance of an REA unit submitting to state jurisdiction on such a matter. As a consequence of Empire Electric's compliance, the commission issued a supplementary order authorizing completion of the deal whereby the co-op acquires Highland Utilities.

The Holy Cross Electric Assn., Inc., another REA group, also has been instructed by the PUC to amend its bylaws before it can acquire public utility property in Eagle County, Colo., but has not yet notified the commission that it has done so.

Court Overrules Demurrer In Condemnation Suit

Demurrer of Pacific Gas and Electric to the condemnation suit brought by the Sacramento Municipal Utility District was overruled last month in the San Francisco Superior Court. PG and E was given 25 days in which to answer the complaint.

Since proceedings were instituted in 1938, the district has sought to convert the Sacramento distribution system of PG and E into a publicly operated enterprise. The California State Railroad Commission in November 1942 set a valuation on the properties of $11,632,000, as against a company figure of $18,302,981 and a district figure of $9,963,000. Requests for rehearing by both the utility and the district were denied by the commission, as was a district request for a review by the California State Supreme Court. Hearings on the PG and E demurrer were heard last September.

BETTER WIRING FOR BETTER LIVING

To help you plan ahead for 194X

WHEREVER groups interested in housing get together these days, they discuss the many problems confronting them regarding postwar construction. Because of the inevitability of increased use of electrical appliances and equipment, they recognize that a radically new approach must be taken in planning *electrically* for new homes as well as for the modernization of present homes.

Questions which are raised in planning this important phase of construction are:

What electrical appliances and equipment will be available for homes? Will there be radical changes in prewar models? What will innovations be like?

How should this equipment be arranged in the kitchen, laundry, utility room, living room, bedrooms, and bath—for greatest efficiency?

How about access for servicing? Utility connections? Lighting outlets and controls?

• • •

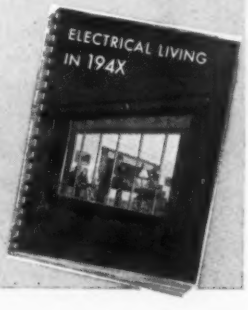
The Westinghouse Better Homes Department is prepared to give you information on these and any other questions relating to the electrical phase of home planning. This Department welcomes the opportunity of giving authentic technical advice on the *proper* selection and planning of home electrical appliances and equipment.

Write: Better Homes Department, Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pennsylvania.

NEW FREE BOOK!

We are preparing a *new and unusual* book which will help you explain to prospective home owners the vital importance of "better wiring for better living" in 194X homes.

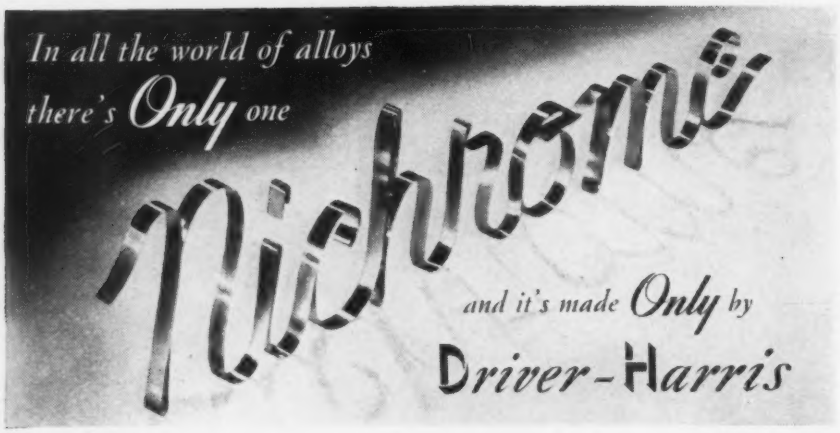
Watch for special announcement and free offer of this big 64-page book in the April issue of this Magazine!



Tune in John Charles Thomas, NBC, Sundays, 2:30 p.m., E.W.T.

Westinghouse

Plants in 25 Cities Offices Everywhere



It takes more than a properly balanced union of nickel and chromium to produce genuine Nichrome.* There is always included at least one extra ingredient. • • Sometimes this hidden ingredient is an added trace of a third metal . . . an improved heating or quenching technique . . . or a specially developed deoxidizing anneal. But always it is the complete mastery with which D-H specialists employ their own exclusive methods and "know how." Remember this when next you buy electrical resistance or heating elements. • • For improved performance and longer life in your post-war products, specify Nichrome* and other resistance alloys by Driver-Harris—the time-tested standard of quality. *Trade Mark Reg. U.S. Pat. Off.

SPECIAL PURPOSE ALLOYS SINCE 1899

Driver-Harris COMPANY

Stocked for the Coast Trade at **ANGUS-CAMPBELL, INC.**

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Main Office and Plant: HARRISON, NEW JERSEY

CHROMALOX HEATFLO

The only unit you need to service ANY electric range. Simplifies servicing — cuts dealer inventories.

EDWIN L. WIEGAND CO.
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61 Fremont St., San Francisco 5, Calif.
420 S. San Pedro St., Los Angeles 13, Calif.
THE PETERSON CO.
1925 Blake St., Denver 2, Colo.

Chromalox Super-Speed Range unit repair parts, also available without priority, under WPB limitation orders.

INSTALLATION COMPLETE IN COULEE POWER HOUSE

Completing the installation in the West power house, unit L-4 was put into operation at Grand Coulee in February. The 108,000-kw. generator brings installed capacity at the dam to almost 800,000 kw.

Six of the eight units in the West power house are rated at 108,000 kw. each. The remaining two, borrowed from Shasta Dam, are 75,000-kw. machines. The building was intended to house nine units but design of the Shasta units required the use of three turbine pits for their installation.

Grand Coulee began producing power in March 1941, with two 10,000-kw. station-service units. Total production in 1941 was about 200 million kilowatt-hours. In 1942 this was stepped up to nearly two million kilowatt-hours and in 1943 to more than four billion.

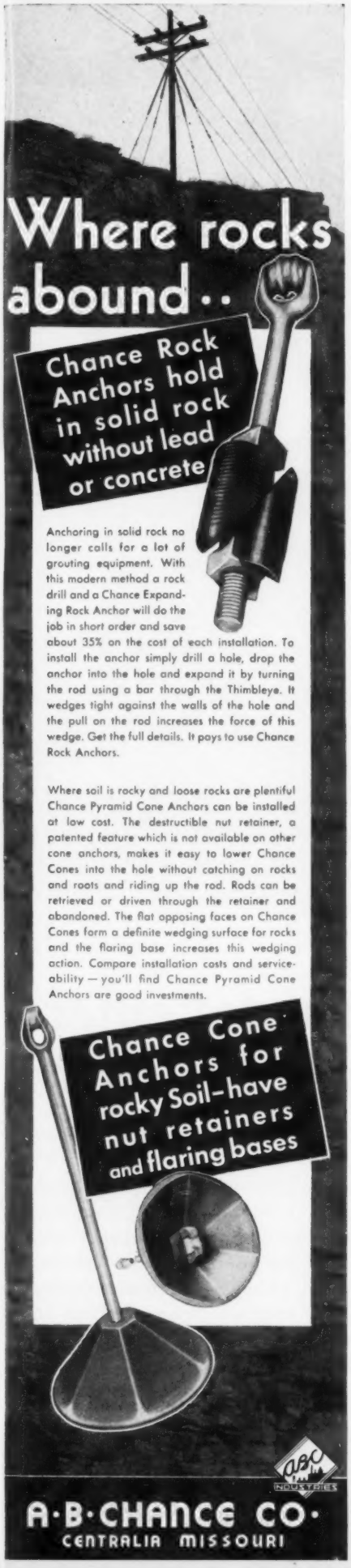
PUD Contract Is Extended Until After Hostilities

Under an extension of the cancellation clause in its contract with the Bonneville Power Administration, Union County (Ore.) PUD will be allowed 18 months following the end of hostilities to acquire a distribution system. The original contract, signed on March 2, 1942, provided for cancellation of the contract after 18 months if the district had not secured a distribution system.

According to Paul J. Raver, Bonneville administrator, the extension was offered because the war made it impossible for the district to acquire a distribution system and for Bonneville to build a transmission line from Pendleton to LaGrande.

● A WAGE DISPUTE last month held up work on construction of Keswick Dam in California's Central Valley Project. An AFL spokesman explained that building and trades unions in Shasta County and the Atkinson & Kier Construction Co. had reached an agreement on wages before the Wage Stabilization Act went into effect but that, after approving the agreement, the Tenth Regional War Labor Board overruled its own stabilization division.

● ELECTRIC REVENUE refunding bonds totaling $15,000,000 will be issued by the Los Angeles Department of Water and Power to effect savings in interest charges. Proceeds will be used to retire 2½ and 2¾% bonds, due 1949 to 1976, by call on April 1.


Where rocks abound..
Chance Rock Anchors hold in solid rock without lead or concrete
Anchoring in solid rock no longer calls for a lot of grouting equipment. With this modern method a rock drill and a Chance Expanding Rock Anchor will do the job in short order and save about 35% on the cost of each installation. To install the anchor simply drill a hole, drop the anchor into the hole and expand it by turning the rod using a bar through the Thimbleye. It wedges tight against the walls of the hole and the pull on the rod increases the force of this wedge. Get the full details. It pays to use Chance Rock Anchors.
Where soil is rocky and loose rocks are plentiful Chance Pyramid Cone Anchors can be installed at low cost. The destructible nut retainer, a patented feature which is not available on other cone anchors, makes it easy to lower Chance Cones into the hole without catching on rocks and roots and riding up the rod. Rods can be retrieved or driven through the retainer and abandoned. The flat opposing faces on Chance Cones form a definite wedging surface for rocks and the flaring base increases this wedging action. Compare installation costs and serviceability — you'll find Chance Pyramid Cone Anchors are good investments.
Chance Cone Anchors for rocky Soil–have nut retainers and flaring bases
A·B·CHANCE CO·
CENTRALIA MISSOURI

COLORADO PROJECTS STUDIED AT MEETING

Development of the Dewey damsite on the Colorado River east of Thompsons, Utah, or another project on the Colorado River in Utah is virtually a certainty within a shorter time than 25 years.

Such was the statement of John C. Page, consulting engineer and former commissioner of the United States Bureau of Reclamation, when he addressed representatives of the seven Colorado River basin states recently in Salt Lake City.

The proposed dam would provide power for vast industrial expansion in Utah as well as control silt deposits in Lake Mead due to floods. The Dewey damsite project would free water, now used for power development, in the Bear River and elsewhere for irrigation, Page declared.

A total of $1,500,000 obtained from sale of Boulder dam power has been set aside for development of resources higher in the basin, of which $800,000 was appropriated for investigations near completion. The Dewey project is one receiving careful study.

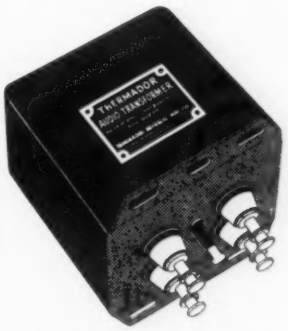
B. C. Power Project Nearing Completion

Power probably will be turned into the new transmission lines of the West Kootenay Light and Power Co., early in May. Announcement to this effect was made recently by E. M. Stiles, president of Kootenay Engineering Co., which is in charge of construction of the new power project on the Kootenay River near Brilliant, B. C.

The new dam at Brilliant is the fourth to be erected on the Columbia River at this point. Two other dams in the same vicinity are also operated by the West Kootenay Power Co. and the fourth dam is in connection with the municipal plant of the city of Nelson. Power from the West Kootenay plant is utilized mainly in the operation of the big smelter and chemical plants of the Consolidated Mining & Smelting Co. at Trail. But the West Kootenay Power Co. also supplies light and power to communities in the Okanagan Valley and in the West Kootenay territory. The new dam is being built to make power available to government plants which have been established at Trail and which are operated by the Consolidated interests.

● The Oak Creek, Colo., municipal electric system is negotiating with the Colorado Utilities Corp. for a power purchase contract. The municipal now buys its power from Moffat Coal Co.

DEFEATS HEAT COLD HUMIDITY



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THERMADOR TRANSFORMERS

Thermador Transformers are Thermatite treated to withstand extreme temperatures and humidity—arid or moist heat—dry or damp cold do not hamper their efficiency. Thermatite is the name of a process of accurate heat controlled vacuum impregnation developed and improved over a period of ten years.

Thermador also manufactures built-in Electric Heaters, Electric Ranges, Electric Water Heaters.

THERMADOR
Electrical Manufacturing Co.
5119 S. Riverside, Los Angeles
"Seven Leagues Ahead"

Only S & C Load Interrupter Disconnects Can Do This Open Type Load Switching Job

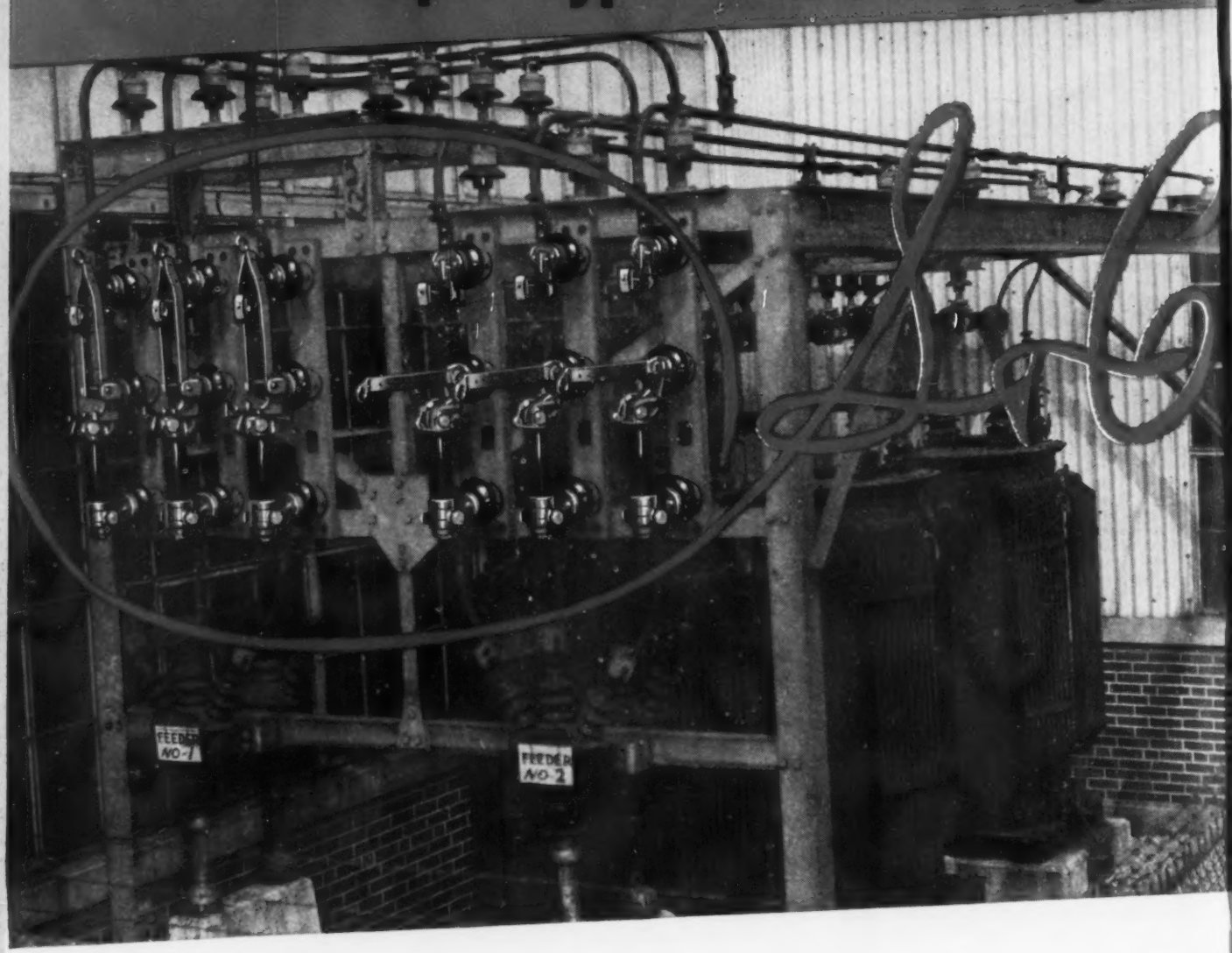

Illustration shows S & C Load Interrupter Disconnects and Type "SM" Fuse installations. Disconnects closed at left and open at right.

Load Switched to Load Centers from Either of Two Sources

TO be sure of continuous service for this essential war plant,—the substation is supplied from two service cables.

To switch to either of these feeders, S & C Load Interrupter Disconnects are installed,—the *only* open type Interrupter Disconnects suitable for outdoor load switching of this kind.

Besides load switching operations short-circuit protection is provided by S & C type "SM" Fuses on the same mounting base.

With S & C Load Interrupter Disconnects, load currents up to 400 amperes at 15000 volts can be interrupted—*without arcing at main switch contacts.* Substantial initial and maintenance savings are effected. Space, weight and installation time are reduced.

Consult S & C engineers the next time you have a job of this kind.

SCHWEITZER & CONRAD, Inc.

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Answer to "Who Am I?"
(See page 86)

Utility Sets Up New High Elevation Snow Courses

Five new high elevation snow courses have been established by the Southern California Edison Co. to augment existing ones in obtaining a more accurate forecast of runoff in the area of its Big Creek hydroelectric development. About 45% of the region draining into its reservoirs, Florence, Huntington and Shaver lakes, is above 10,000 ft. in elevation, while 44% is between 7,500 and 10,000 ft. Only 11% is below 7,500 ft.

This spring, snow on the following courses will be measured by the snow surveyor's slotted tube and scale for the first time: Blaney Meadows, 7,700 ft.; Heart Lake, 10,100 ft.; Colby Meadow, 10,000 ft.; Emerald Lake, 10,800 ft.; Nellie Lake, 8,250 ft.

The first four courses, with the existing Edison course at Dutch Lake, 9,100 ft., and the state's course at Piute Pass, 11,200 ft., will provide a closer check on snow conditions in the country surrounding the upper south fork of the San Joaquin River, one of Florence Lake's main drainage courses.

● UTAH COPPER CO. puts its 50,000-kw. electric power plant at Magna into operation last month, to supply energy for operations at the Magna and Arthur mills and at the open cut mine in Bingham Canyon. The unit was started in February 1942, and is the second large industrially owned plant to be put into operation in the area recently. The other is the Geneva Steel Co. plant, which also has 50,000 kw.

PEOPLE
made this news

Courtright To Head PG and E Division

H. H. (Kelly) Courtright, president and general manager of the Valley Electrical Supply Co., has been named division manager of the San Joaquin Power division, Pacific Gas and Electric Co., succeeding Ernest P. Smith, who was to retire March 1, because of ill health. Courtright will continue in his present position with Valley Electrical Supply.

Smith has been in the service of the company for nearly 37 years and for the last 18 years has been in direct charge of the San Joaquin Power division. In 1905 he went to work for the Farmers National Bank of Fresno, and in 1907 accepted a position as clerk with the San Joaquin Light and Power Co. He became chief clerk in 1913, assistant auditor in 1917, assistant to the general manager in 1920 and in 1926 became assistant to the vice-president and general manager. Later he was made assistant to the president.

Courtright has been associated with the Valley Electrical Supply Co. for 32 years, and has been manager of that organization since 1916 and president and general manager since 1927. He is widely known in the gas and electric industry, and in 1928 received national recognition when he was awarded the James H. McGraw Award for the development of the "Through the Dealer" plan of dealer cooperation in utility appliance merchandising.

● R. E. FISHER, vice-president in charge of public relations and sales for Pacific Gas and Electric Co., was recently named Coastal Area district chairman of the Committee for Economic Development. The committee's objectives are to provide maximum postwar employment and maintain production at the highest possible level. As chairman of the San Francisco Chamber of Commerce postwar planning committee last year Fisher was instrumental in preparing an itemized guide to postwar action in San Francisco.

● H. E. BIXBY, formerly with the Bonneville Administration, has been appointed chief of the regional branch of power utilization for the U. S. Bureau of Reclamation, with headquarters at Sacramento, Calif. He will be responsible for operating and maintaining the electric power generation, transmission and distribution plants and facilities of the Central Valley Project. While with Bonneville, Bixby was successively chief of distribution operations and chief of commercial operations.

COURTRIGHT

● APPOINTMENT of Ira Rowell, San Francisco attorney, as a member of the California State Railroad Commission was announced recently by Governor Earl Warren. Rowell, who was connected with the commission from 1927 to 1943 as examiner, assistant attorney and latterly as chief counsel, fills the vacancy caused by the death of Carl C. Baker. He is the only lawyer on the commission.

● W. E. LEE has been appointed marine division representative by Westinghouse Electric & Mfg. Co., with headquarters in Los Angeles. He succeeds E. W. Fullman, who resigned to become sales engineer for Fahnir Bearings, Inc., in the Los Angeles area. Lee has been with Westinghouse since 1936, most recently as electrical application engineer at Los Angeles.

● J. S. ALLEN, safety supervisor and personnel director for California Electric Power Co., resigned recently to join the B. F. McDonald Co. in San Francisco. Allen joined the company in 1921, had been in charge of safety work since 1929 and of personnel since 1937. The McDonald company manufactures and distributes workmen's safety devices.

● KEN REID, assistant electrical engineer at Victoria, B. C., has been granted leave of absence for five months by the city. His services were sought by the War Emergency Training Program to instruct young soldiers as electricians.

The New Curtis WARRIOR

A FLUORESCENT UNIT for OFFICES AND DRAFTING ROOMS

Designed and Packaged FOR PRACTICABILITY

Interested in lighting or relighting an office? Today's best and safest buy is Curtis "Warrior" for four 40-watt fluorescent lamps. This attractive unit will provide the efficient, comfortable lighting needed by a busy staff. Conveniently packaged, "Warrior" is designed for quick, easy installation and maintenance, and guaranteed by the Curtis reputation for quality and dependability.

Get in touch with your local Curtis representative:
W. K. Turner, Terminal Sales Bldg., Seattle 1, Wash.

CURTIS Lighting, INC.
6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

ILSCO Electrical Connectors

WHY SO DEPENDABLE?

Because made from maximum conductivity *seamless* copper tubing drawn in our own plant.

Wire sizes stamped on barrel of each lug; tongues have smooth, flat surfaces; barrel ends cut off straight to fit snugly against wire insulation; shipped brightly clean to speed soldering.

Ilsco Approved Single Hole Soldering Lugs

Western Distributors:
ELECTRICAL SPECIALTY CO.,
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STRIEBY & BARTON, LTD.
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Give Better
Commutation,
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225 W. Pico Boulevard
Los Angeles, California

Baughman Hotpoint Sales Manager at Los Angeles

E. J. Baughman, formerly sales specialist for Hotpoint on the Pacific Coast, has been appointed Los Angeles district sales manager by the appliance company.

A native of California and a graduate engineer of Stanford University, Baughman is well known on the Pacific Coast. Following experience as mechanical, civil and radio engineer and laboratory technician, he spent ten years as appliance salesman throughout the Pacific Coast states.

BAUGHMAN

● V. L. BOARD, retired vice-president of the Public Service Co. of Colorado, has been appointed director of WPB's Denver region. Board has been acting regional director since the resignation of Leslie A. Miller early in January. Previously, he had been chief deputy director. Board joined the old Office of Production Management in June 1941, after his retirement.

● LEONARD J. MOORE, for 13 years executive engineer of the San Joaquin Power Division of the Pacific Gas and Electric Co., has retired because of illness, according to an announcement by A. Emory Wishon, vice-president and general manager. Moore was with the company 33 years. He is a fellow of the American Institute of Electrical Engineers.

● JAMES L. COOK, of the Joslyn Co. of California, recently was transferred from the Los Angeles office to San Francisco.

Crosley Appoints Dinkel Coast Representative

Appointment of N. B. Dinkel as Pacific Coast representative was announced recently by the Crosley Corp. Dinkel has been associated with the appliance industry since 1927 and has spent much of that time on the Pacific Coast.

During the past two years, he has been engaged in war work in the San Francisco Bay area, for a contracting syndicate. He was in charge of a recruiting program, operating six branch offices in widely scattered points in the United States, through which men were employed for construction projects on islands in the Pacific.

DINKEL

Previous to joining the appliance industry, Dinkel was with a securities firm in New York.

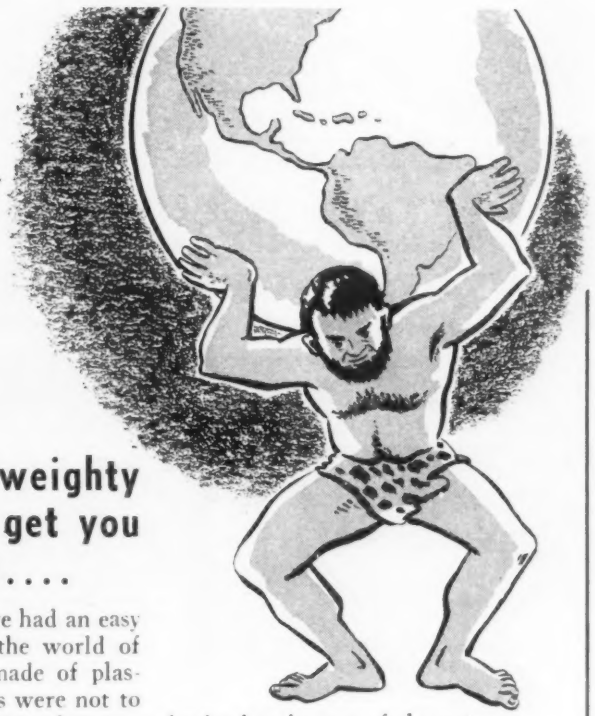
● MARGURETTE REINHART, former home service director for Idaho Power Co., has been appointed director of Universal's newly organized laboratory of modern living. In her new position, Miss Reinhart will work with the engineering promotion and sales departments of Landers, Frary & Clark in development of Universal electric appliances and household specialties. While with Idaho Power, Miss Reinhart won the McCall Award for outstanding contribution to the advancement of electrical living.

● HENRY A. MITCHELL has been named chief accountant by Public Service Co. of Colorado. He succeeds W. D. Virtue, who became vice-president and secretary during the recent reorganization.

SALES ENGINEERS ELECTRICAL

Electrical manufacturer in war work will train electrical engineers and students of electricity for field application of motors (Sales). Permanent position. Well established company. Age 25-35. Salary and commission. State full experience and earnings.

Reply "West," Box 1391, Main Post Office, Los Angeles 53, California.



don't let weighty problems get you down....

Atlas would have had an easy job of it, had the world of his time been made of plastics. But plastics were not to be for the ancients; they were destined to be one of the outstanding achievements of modern science.

The Continental-Diamond line of plastics—in sheets, rods and tubes—has become the standard in dozens of industrial fields. They are no longer used as *substitutes*, but are eagerly sought for as *betterments*. Marwood maintains large stocks of Continental-Diamond plastics in its four strategically located Pacific Coast warehouses. If you have a problem involving the replacement of corrosive, weighty or hard-to-get materials write Marwood concerning the application to your problem of one or more C-D plastics—

CELORON VULCOID
DILECTO
MICABOND DILECTENE
DIAMOND VULCANIZED FIBRE

MARWOOD LIMITED

Pacific Coast Representatives for Continental-Diamond Fibre Company

SEATTLE PORTLAND SAN FRANCISCO LOS ANGELES

☆

No. 825

Sylvania Names New Personnel In West

Sylvania Electric Products Inc. has announced appointment of additional personnel on the Pacific Coast to take care of enlarged operations.

B. K. Wickstrum will be Pacific Coast sales manager for lighting products. He will be assisted by C. W. Dickinson as manager of the Northwest division and G. W. Field, manager of the California division, which includes Nevada, Utah and Arizona. Wickstrum and Field will have head-

WICKSTRUM

quarters in Los Angeles and Dickinson will be at Seattle.

All three men had been with Sylvania previously, Wickstrum as advertising manager of the lighting division, Field as northeastern field engineer, and Dickinson as representative in New England and the southwestern region.

● J. C. Williams has been placed in charge of the Oakland branch of the Westinghouse Electric Supply Co. Williams has been supply sales manager for the San Francisco house for several years.

● Thomas Ludke, formerly agent for Pacific Gas and Electric Co. at Mill Valley, has been transferred to San Francisco headquarters in the public relations department.

● John A. Ford, Jefferson Electric Co. representative in Seattle, is now with the factory in Belwood, Ill.

A Size for Every Wire Joint
IDEAL
Wire-Nuts
Solderless, Tapeless Wire Connectors

NO RESTRICTIONS

Government approved as alternate for solder-and-tape joints. Simply strip wires, screw on—that's all! Fully Approved. Listed by Underwriters' Laboratories, Inc.

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FREE *Samples on Request*

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J. E. Beggs, 1206 E. 61st St., Seattle, Washington

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SMOOT-HOLMAN COMPANY
SIGHT-CRAFT
INGLEWOOD CALIFORNIA
MADE IN U.S.A.

LUMINAIRES FLUORESCENTS
REFLECTORS FLOODLIGHTS

INDUSTRIAL AND COMMERCIAL LIGHTING EQUIPMENT

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STEVENS SALES CO., 41 Post Office Place, Salt Lake City, Utah

Westinghouse Supply Co. Promotes Barker, Miles

Westinghouse Supply Co. has announced appointment of John N. Barker as northern California district appliance manager, and of William C. Miles as district application data manager. Both men will have headquarters in San Francisco.

Barker was formerly district accounts supervisor for the Westinghouse electric appliance division at San Francisco. Miles was promoted from the post of appliance supervisor.

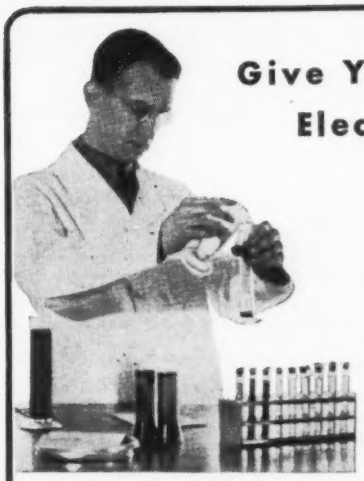
● GEORGE K. COMSTOCK, president of Electrical Products Consolidated, Seattle, resigned as director of the regional War Production Board for the Pacific Northwest in Seattle Jan. 1. Comstock took the job last June when Northwest business men won a fight to create a regional office in Seattle to handle WPB affairs in Washington, Oregon, the Idaho panhandle and Alaska. He took the post with the understanding that as soon as it was organized he would return to his own business. Kenneth B. Colman has been named in his place.

● HAROLD PANGBORN, California Electric Power Co., has been named district manager for the company's Hemet-San Jacinto district. He succeeds B. F. Himes, who retired after 35 years of service. Pangborn has been with the company since 1930, starting as groundman. Himes was employed by the Lytle Creek Power Co. of San Bernardino, which was purchased by California Electric Power. He later was superintendent of power at Elsinore and had been in charge of the Hemet-San Jacinto area since 1918.

● J. E. N. HUME, of Schenectady, commercial vice-president of the General Electric Co., toured the West last month on an inspection trip. He visited industrial plants in Tucson, Phoenix, San Diego, Los Angeles and San Francisco. Hume is in charge of the company's industrial department.

● DEAN L. DUTTON, former chief operator at the Onedia plant of the Utah Power & Light Co., has been made superintendent of the Ashton plant at Ashton, Idaho. He replaces D. O. Rawson who has been made superintendent of the Weber plant.

● HAROLD D. CONKLIN, district manager for the Pacific Southwest for Edison General Electric Appliance Co., with home in Los Angeles, has been transferred to the Hotpoint factory in Chicago as manager of Hotpoint range and water heater sales division.



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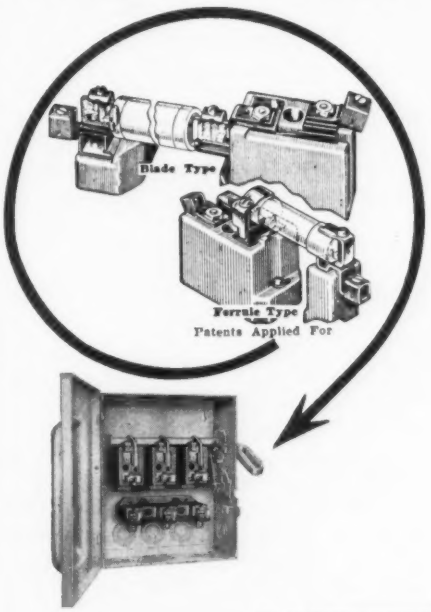

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Hospital Signal Systems Motor Plugs—Receptacles

TRICO FUSE MFG. CO.
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KNOX PORCELAIN CORP.
Electrical Porcelain

● TOM E. SHEA has been appointed executive assistant on the staffs of Pacific Power & Light and Northwestern Electric companies. He will work under the general supervision of John Dierdorff, advertising supervisor, and among his duties will be assistant in preparation of various studies and reports. Shea was editor of the Portland *News-Telegram* prior to its purchase by the *Journal* and more recently had been manager of the Oregon Motor Transport Assn.

● F. LOWELL GARRISON, formerly General Electric Co. representative at Butte, Mont., has been appointed public relations manager for the Western region for G-E. He succeeds Paul C. Wilmore, who has been appointed manager of one of G-E's distributing branches in Cincinnati, Ohio.

● GILBERT TROSPER, formerly in lighting sales for the San Francisco division, has been transferred to the main office of Pacific Gas and Electric Co. to head up lighting sales, succeeding William P. Bear, who retired Jan. 1.

● BRUCE BROMLEY, for many years in the field for Westinghouse Electric Supply Co., San Francisco, in various parts of northern California, has joined T. L. Rosenberg Co., industrial electrical contractor, Oakland.

● S. W. "SHEP" MURRAY, recently retired from Westinghouse Electric Supply Co. as credit manager in Los Angeles, is now associated with the California Wholesale Electric Co. of that city.

● L. M. TRIM, chief electrical inspector of Burbank, Calif., has joined the U. S. Navy and is in training in Virginia. He was given the rank of lieutenant (j.g.)

Obituary

● J. E. CHANDLER, electrical contractor of Los Angeles and Arcadia, Calif., died suddenly recently while supervising the large du Pont project in Washington, whose electrical work is being installed by a syndicate of Chandler, Newbery & Lord. Chandler had handled electrical installations for many large projects in the West and was known particularly for the wiring of the Los Angeles Union Terminal.

● GEORGE W. LEE, retired manager for PG and E at Fairfield, Calif., died last month at the age of 69. He went to Fairfield in 1928, retiring in 1941.

● CHARLES PAUL RHINE, division maintenance engineer for the San Joaquin Power division of Pacific Gas and Electric, died on Jan. 17 at the age of 60 in Berkeley, Calif. Beginning his career with the Southern Pacific Co. after receiving a degree in electrical engineering from Purdue in 1909, Mr. Rhine transferred to the San Joaquin Light & Power Corp. in 1918 and filled various engineering positions with them and the PG and E until his death.

● WALTER HENRY CHARBONEAU, electrical contractor of Stockton, Calif., died early in February after a long illness.

Member A.I.E.E
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H. Geo. Shefler, P.O. Box 1587.....Phoenix

TRADE notes

Columbia Electric Gets Army-Navy E Award

Columbia Electric & Mfg. Co. of Spokane recently received the Army-Navy E award.

With the announcement came a report from Walter Toley, production manager, that the firm holds a new contract from the war department for the manufacture of shells. It already holds contracts with the Navy for valves, electric fittings and radio control equipment as well as for aircraft repair work.

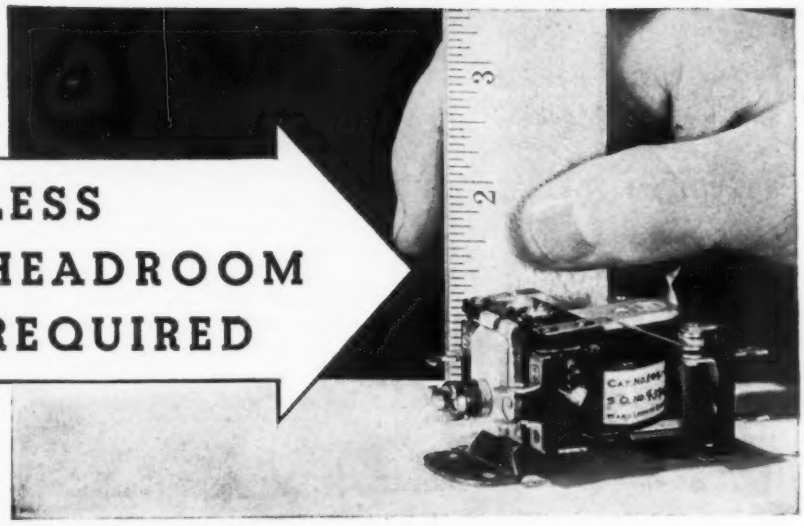
Congratulations to the firm's employees were sent from Mexico by Eric A. Johnston, president of Columbia Electric, who was absent in connection with his duties as president of the United States Chamber of Commerce.

● Roy M. Butcher, San Jose electrical contractor, has moved his office and shop from the ingenious and inconspicuous one he has had at the rear of his residence in San Jose to larger quarters at 510 West San Fernando St. He also has opened an electrical repair and motor rewinding shop at this location. Butcher is chairman of the California State Contractors License Board and a member of the directorate of Northern California Chapter, NECA.

● C. F. Forsburg has joined the Geo. E. Honn Co., manufacturers' representatives with headquarters in San Francisco. A native of Kansas and a graduate of Kansas State College, Forsburg was for many years a member of the General Electric sales organization on the Pacific Coast, resigning in 1930 to set up his own agency business in Los Angeles. For the past ten years he has been electrical engineer for the Honolulu Oil Corp. at Taft, Calif.

● Daniel Woodhead Co. of 15 Jefferson St., Chicago, Ill.. has enlarged the territory for which Clyde L. Chamblin Co., 400 Mission St., San Francisco and 1518 W. 7th St., Los Angeles, is representative, to include all of California. The company makes Watertite and Protex brands of cord sets, rubber sockets and guards.

● Hubbard And Co., Emeryville, Calif., has been awarded the second star for its Army-Navy E pennant, it was announced last month by W. W. Closser, vice-president of the Pacific Coast division.



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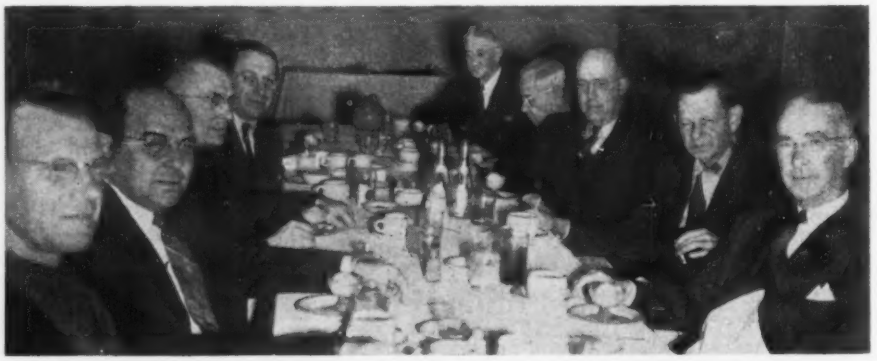
PROFILES *of the month*

Mrs. and George Abbett, president of San Francisco Electrical Contractors Assn., at the dinner in honor of his re-election and to promote reaquaintance

Below: At NECA chapter meeting in Fresno were T. L. Rosenberg, Oakland; J. G. Jeffrey, Fresno; W. J. Varley, field representative, NECA; Frank Thomas, and T. M. Robinson, Fresno

Bakersfield electrical contractors meet with new NECA officers below. Left to right, H. Gerand, E. H. Kuehn, Louis F. Bauer, T. L. Rosenberg, Oakland, president No. Calif. Chapter; E. J. Gartley, Jim Baker, M. L. Poundstone, Porterville; W. T. Drury, and W. J. Varley, NECA field representative



Directors of the Northern California Chapter, NECA, (formerly Northern California Electrical Contractors Assn.) at first meeting in new headquarters in Western Merchandise Mart, San Francisco. Left to right, at rear, W. J. Varley, western field representative, NECA; T. L. Rosenberg, Oakland, president of the chapter; seated, J. D. O'Connor, Sacramento; G. W. Abbett, San Francisco; Roy Butcher, San Jose; W. T. Drury, Bakersfield; Edward Pierce, Vallejo; Seth Cohn, San Mateo. Grover Grider, Stockton had left, and Wesley Evans, Salinas, and Harry Eklund, San Rafael, were absent from the meeting.

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